

***United States Court of Appeals
for the
District of Columbia Circuit***



**TRANSCRIPT OF
RECORD**

TRANSCRIPT OF RECORD

United States Court of Appeals for the
District of Columbia

JANUARY TERM, 1937.

No. 6916

120

REGINALD A. FESSENDEN, APPELLANT,

vs.

CONWAY P. COE, COMMISSIONER OF PATENTS.

APPEAL FROM THE DISTRICT COURT OF THE UNITED STATES FOR
THE DISTRICT OF COLUMBIA.

FILED FEBRUARY 23, 1937

PRINTED APRIL 22, 1937

United States Court of Appeals for the
District of Columbia

JANUARY TERM, 1937.

No. 6916

REGINALD A. FESSENDEN, APPELLANT,

vs.

CONWAY P. COE, COMMISSIONER OF PATENTS,
APPELLEE.

APPEAL FROM THE DISTRICT COURT OF THE UNITED STATES FOR
THE DISTRICT OF COLUMBIA.

INDEX.

	Original	Print
Caption	a	1
Bill of complaint as amended	1	1
Answer	7	7
Order substituting Conway P. Coe as defendant	11	10
Findings of Fact	11	10
Conclusions	16	14
Final Decree	16	15
Appeal noted by plaintiff and allowed, penalty of under- taking fixed, &c.	17	15
Memorandum: \$50.00 cash in lieu of bond on appeal	17	15
Assignments of Error	18	15
Order making Statement of Evidence part of record	20	17

	Original	Print
Designation of Record on Appeal	20	17
Clerk's Certificate	22	18
Statement of evidence and stipulation	23	19
Testimony of Greenleaf Whittier Pickard	29	22
Certificate of Commissioner of Patents	74	52
Specification in the matter of the application of Reginald A. Fessenden	75	53
Drawings in the matter of the application of Reginald A. Fessenden	80	57
Examiner's Statement	82	60
Opinion of the Board of Appeals	89	66
Decision of the Law Examiner on the Motion to Dissolve and the Motion to Amend	92	68
Opinion of the Board of Appeals on the Appeal from the de- cision of the Law Examiner	97	72
Patent of Frank W. Peek, Jr., No. 1,741,333	101	77
Patent of Charles Le G. Fortescue, No. 1,259,385	106	82
Patent of Chester H. Thordarson, No. 1,288,751	110	86
Patent of K. C. Randall, S. W. Farnsworth and C. Le G. Fortescue, No. 1,129,521	114	90

United States Court of Appeals for the District of Columbia

a. District Court of the United States for the
District of Columbia.

In Equity No. 54193

REGINALD A. FESSENDEN, *Plaintiff*,

v.

THOMAS E. ROBERTSON, *Commissioner of Patents*,
Defendant.

UNITED STATES OF AMERICA,
District of Columbia, ss:

BE IT REMEMBERED, That in the District Court of the
United States for the District of Columbia, at the
City of Washington, in said District, at the times
hereinafter mentioned, the following papers were
filed and proceedings had, in the above-entitled
cause, to wit:—

1 *Bill of Complaint as Amended*

Filed April 5, 1932

In the Supreme Court of the District of Columbia.

In Equity: No. 54193

REGINALD A. FESSENDEN, *Plaintiff*,

v.

THOMAS E. ROBERTSON *Commissioner of Patents*,
Defendant.

The plaintiff states as follows:

1. The plaintiff, Reginald A. Fessenden, is a citizen of
the United States and a resident of Newton in the County
of Middlesex, and State of Massachusetts, and brings this
suit in his own right.

2. The defendant, Thomas E. Robertson, is the Commis-
sioner of Patents of the United States, a legal resident of

the District of Columbia, and is sued as Commissioner of Patents of the United States.

3. This Bill is filed in accordance with the provisions of the Federal laws of the United States as provided for under Revised Statutes 4915.

4. The plaintiff Reginald A. Fessenden, filed an application for a patent in the United States Patent Office entitled HIGH TENSION INSULATORS on January 28 1922 which was given the serial No. 532,488.

5. The said application was filed in accordance with the laws of the United States and the Rules of the Patent Office.

6. The said application has been duly prosecuted in accordance with the laws of the United States and the
2 Rules of the Patent Office.

7. The said application was examined by the Primary Examiner and was forwarded by him as stated in a communication from the Commissioner of Patents dated September 20, 1927 to the Examiner of Interferences because it was adjudged to interfere with another case as specified therein, namely an application for insulated supports filed by Frank W. Peek Jnr., whose post-office address was c/o General Electric Company, Pittsfield, Massachusetts, and whose assignee was the General Electric Company Schnectady, New York, a corporation of New York.

The specific claims adjudged to interfere were as follows:

1. A string of more than two interconnected units adapted to support an electrical conductor, said string being provided with electrostatic flux controlling means conductively connected to the conductor and proportioned and situated about the insulating units so as substantially to compensate directly for the leakage electrostatic flux of the string whereby uniform voltage distribution results.

2. The combination with a line conductor, of a plurality of insulating units joined in a string by metallic connections and supporting said conductor, and a conducting member conductively connected to said line conductor and proportioned and located in the electric field adjacent the line end of said string to supply directly to each unit a capacitance current substantially equal to the capacitance current from the unit to ground.

8. In accordance with the communication of September 20th 1927, an interference No. 55,844 was declared in the United States Patent Office.

9. In the prosecution of said interference, the party Peek made a motion to dissolve the interference on the ground that Fessenden did not describe the invention covered by the claims of the interference. The plaintiff, the party Fessenden made a motion to amend by adding four
3 additional counts.

10. Both motions were heard together by the Law Examiner, Mr. I. P. Disney, who rendered a decision dated October 16, 1928 dissolving the interference and disallowing the plaintiff to amend.

11. An appeal was taken to the Board of Appeals of the Patent Office, which heard the appeal on June 21, 1929 and rendered its decision on September 10th, 1929 in which the Law Examiner's decision was affirmed.

12. The case was then returned to the Primary Examiner who in an action dated November 5, 1929 rejected all of the claims standing in the application.

13. The plaintiff in the meantime had filed suit under Section 4915 of the Revised Statutes in the United States District Court for the Northern District of New York, naming the General Electric Company the assignee of the party, as adverse party in the suit which case was given an equity number No. 1,845.

14. The adverse party, the General Electric Company appeared specially and pleaded to the jurisdiction of the Court on the ground that the question of priority had not been decided by the Patent Office.

15. The Court for the United States District for the Northern District of New York, (Judge Cooper) dismissed the Bill on the ground of the lack of jurisdiction and the plaintiff continued the prosecution of the application in the Patent Office.

16. The primary Examiner in his letter of September 29, 1930 finally rejected all the claims standing in the application. The plaintiff appealed from the final rejection of the Examiner to the Board of Appeals on March 25,
4 1931. The appeal was heard on October 8, 1931 and in the decision of October 29 1931, the Board affirmed the decision of the Examiner.

17. The appealed claims are as follows:

5. In high tension insulators, a conductor to be insulated, an insulator string embodying a plurality of small capacity insulators connected in series, and a potential equalizing conductor electrically connected with said conductor to be insulated and spatially related to a unit of said insulator string in immediate proximity to said conductor to be insulated, whereby said unit is relieved from undue electrical stress and such stress distributed across the units of the string, and whereby said conductor to be insulated is thereby enabled to withstand a higher voltage.

6. In high tension insulators, a conductor to be insulated, an insulator string embodying a plurality of insulator units, and potential equalizing means in spaced relation to an end unit of the string subjected to its undue proportion of electrical stress and operative for relieving such unit of overstress and distributing such stress over the remaining insulator units of said string.

9. In high tension insulators, a conductor to be insulated, an insulator string embodying a plurality of insulator units, and a potential equalizing conductor in electrical connection with the conductor to be insulated and including a substantially imperforate portion of cylindrical form spatially surrounding at least an end insulator of the string.

10. In high tension insulators, a conductor to be insulated, an insulator embodying a plurality of insulator units, and a substantially imperforate potential equalizing conductor of substantially circular cross-section surrounding an end unit of said insulator.

11. In high tension insulators, a conductor to be insulated, an insulator embodying a series of insulator units, and curved potential equalizing shields disposed respectively spatially around the end units of the series.

14. In high tensions insulators, a conductor to be insulated, an insulator embodying a series of insulator units, and an electrostatic shield of annular form spatially surrounding at least a part of said insulator, said shield having a lip portion of widened cross-section.

15. In high tension insulators, a conductor to be insulated, an insulator string embodying a plurality of insulator units, and means for electrostatically distribut-

5 ing the normally excessive electric stress from a point of high tension at or near one end of the insulator string across the units of the string.

16. In high tension insulators, a conductor to be insulated, an insulator string embodying a plurality of insulator units, and means for electrostatically distributing the excessive electric stress from the high tension line end of the string across the units of the string.

23. A string of more than two interconnected insulating units adapted to support an electrical conductor, said string being provided with electrostatic flux controlling means conductively connected to the conductor and proportioned and situated about the insulating units so as substantially to compensate directly for the leakage electrostatic flux of the string, whereby uniform voltage distribution results.

24. The combination with a line conductor of a plurality of insulating units joined in a string by metallic connections and supporting said conductor, and a conducting member conductively connected to said line conductor and proportioned and located in the electric field adjacent the line end of said string to supply directly to each unit a capacitance current substantially equal to the capacitance current from the unit to the ground.

The claims 23 and 24 being the claims of the interference.

18. The Commissioner of Patents, by the Board of Appeals contends that the plaintiff cannot make claims 23 and 24 for the reasons set forth by the Law Examiner. The Board of Appeals also contend that the claims do not patentably distinguish from the references relied upon by the Examiner.

The references relied upon are:

Fortesque	1,259,385.	patented	March 12, 1918.
Randall et al.	1,129,521	"	Feb. 23, 1915,
Thordarson	1,288,721	"	Dec. 24, 1918.

19. The plaintiff disagrees with the contention of the Commissioner of Patents as stated above and contends that the invention as defined by the claims, considered by the Board of Appeals and presented in this Bill are not anticipated by the patent relied upon by the Commissioner of Patents, and contends further that the disclosure in the ap-

plication is sufficient to warrant the allowance of the claims set forth above.

6 20. The plaintiff contends also that the decision of the Law Examiner and the decision of the Board of Appeals in the first instant were inconsistent with one another, and that the Law Examiner found that the electrostatic flux controlling means was conductively connected, whereas the Board of Appeals relied upon the fact that it was not so connected in deciding against the plaintiff. The Board of Appeals held that but for the fact that the grid must be connected to the power conductor, the plaintiff would have been entitled to the claims, thus overlooking the statements made by the Law Examiner.

21. The plaintiff states that he has not taken appeal from the decision of the Board of Appeals to the Court of Customs and Patent Appeals.

22. The plaintiff further states that the said invention is new and useful, and was not known or used by others in this country before his invention thereof, and not patented or described in any printed publication in this or any foreign country before his invention thereof, or more than two years prior to his application for patent therefore, and not in public use or on sale in this country for more than two years prior to said application, and not patented in any foreign country by him or his legal representatives on an application filed more than twelve months prior to said application for United States patent and not abandoned.

WHEREFORE, the plaintiff prays that the Honorable Court may adjudge that the applicant is entitled to receive a patent for his invention as specified in his claims or for any part thereof as the facts in the case may appear, and that the Honorable Court may decree that the Commissioner of Patents be directed to allow said claims
7 and such other claims as upon hearing the Court may find patentable.

REGINALD A. FESSENDEN,
Plaintiff.

I. R. PARIS,
Solicitor.

EZEKIEL WOLF
Of Counsel.

This 29 day of March 1932, personally appeared before me the above named Reginald A. Fessenden, the plaintiff named in the foregoing Bill, and being duly sworn did depose and say that he has read the foregoing Bill and that the same is true to the best of his knowledge and belief.

CLAY MERRELL

Vice Consul of the United States

(Seal)

American Consulate

Mar 29 1932

Hamilton, Bermuda

American
Consular Service

\$2

Fee Stamp

Answer

Filed April 22, 1932

* * * * *

To the Honorable

The Judges of the Supreme Court
of the District of Columbia.

Thomas E. Robertson, Commissioner of Patents, defendant herein, in answer to the Bill of Complaint alleges on information and belief as follows:

1. He admits for the purpose of this suit the allegations of paragraph 1.

8 2. He admits the allegations of paragraph 2 except to state that his official residence is in the District of Columbia and that his legal residence is in the State of Maryland.

3. He admits the allegation of jurisdiction under Section 4915 R. S.; 35 U. S. C. A. 63.

4. He admits that plaintiff on the 28th day of January 1922 filed an application for letters patent to which Serial No. 532,488 was given.

5. He admits that the said application was filed in accordance with the laws and rules.

6. He admits that the said application was duly prosecuted.

7. He admits the allegations of paragraph 7.

8. He admits that Interference No. 55,844 was declared in the United States Patent Office.

9. He admits that in the said Interference the party Peek made a motion to dissolve the interference on the ground that Fessenden did not describe the invention covered by the claims of the interference and that Fessenden made a motion to amend by adding four additional counts.

10. He admits that the motions were heard together by Law Examiner Disney, who rendered a decision dissolving the interference and disallowing plaintiff's motion to amend.

11. He admits that an appeal to the Board of Appeals was taken, which Board affirmed the decision of the Law Examiner.

12. He admits that the plaintiff's application was returned to the primary examiner, who rejected all of the claims standing in the application.

13. He admits for the purpose of this suit the allegations of paragraph 13 with respect to the Equity suit filed by plaintiff in the United States District Court in the Northern District of New York, which was given Equity No. 1845.

14. He admits that the General Electric Company raised a question of jurisdiction as stated in paragraph 14.

15. He admits that the Court dismissed the bill on the ground of lack of jurisdiction.

16. He admits that in the further prosecution of the application in the Patent Office the primary examiner finally rejected all the claims standing in the application, that appeal was taken to the Board of Appeals, and that the Board of Appeals in a decision rendered October 29, 1931, affirmed the examiner.

17. He admits that the appealed claims are set forth in paragraph 17.

18. Defendant further states that plaintiff's disclosure does not support claims 23 and 24 and that all of the claims standing in plaintiff's application are unpatentable over the following prior patents, viz.:

Fortescue,	1,259,385,	March 12, 1918,
Thordarson,	1,288,751,	Dec. 24, 1918,
Randall,	1,129,521,	Feb. 23, 1915.

Profert of copies of said patents is hereby made.

19. Paragraph 19 merely states plaintiff's conclusions and hence requires no answer.

20. Defendant denies the allegations of paragraph 20.

21. He admits that plaintiff has taken no appeal to the United States Court of Customs and Patent Appeals.

22. He has no information with respect to plaintiff's allegations of invention and the non-existence of statutory bars except as informed by the Bill and by plaintiff's said application.

10 FURTHER ANSWERING defendant denies that the claims for which plaintiff contends are patentable to him as more fully appears from the statement of the examiner, the decision of the Law Examiner, and the decision of the Board of Appeals. Copies of said statement and decisions will be presented at the hearing.

AND FURTHER ANSWERING defendant denies each and every allegation of the Bill of Complaint not herein specifically and sufficiently denied or admitted, and prays that plaintiff's Bill of Complaint be dismissed.

WHEREFORE defendant having fully answered the Bill of Complaint denies that plaintiff is entitled to the relief demanded or any part thereof and prays that he be hence dismissed with all costs of the proceedings against the plaintiff as provided in Section 4915 R. S.

THOMAS E ROBERTSON
Commissioner of Patents,
Defendant.

T. A. Hostetler,
Solicitor of the U. S.
Patent Office,
Attorney for Defendant.

DISTRICT OF COLUMBIA,
City of Washington, ss:

I, Thomas E. Robertson, Commissioner of Patents, depose and say that I have read the above answer by me subscribed and know the contents thereof, and that the statements of facts therein made as upon personal knowledge

are true, and those made upon information and belief I believe to be true.

THOMAS E ROBERTSON
Commissioner of Patents.

11 Subscribed and sworn to before me this 20th day
of April, 1932.

(Notarial Seal) ALBERT W. KAISER
Notary Public, D. C.

My commission expires Apr. 6, 1933.

Order Substituting Conway P. Coe as Defendant

Filed December 11, 1933

* * * * *

Upon consideration of the motion filed by plaintiff herein, it is hereby ORDERED this 11th day of Dec., 1933, that the Hon. Conway P. Coe, Commissioner of Patents, be substituted as defendant for the Hon. Thomas E. Robertson, formerly Commissioner of Patents.

F D LETTS
Justice.

Findings of Fact

Filed July 22, 1936

* * * * *

This is a bill brought under 35 U. S. C. A. §63 to authorize the issuance of a patent.

The application was duly filed in the Patent Office January 8th, 1933, and relates to a string type insulator for use in insulating high tension power lines from the supports which carry them.

The invention refers to means for equalizing the potential differences between the successive units of a string of electric insulators. The unit of such a string next adjacent the high tension line is, in the absence of any equal-
12 izing means, subjected to greater electrical stress than the remaining units. Fessenden proposes to remedy this defeat by disposing an electrostatic shield adja-

cent an end of the insulator string, thus insuring a uniform distribution of potential among the units of the string.

At the hearing certain of the claims in the bill were withdrawn by the plaintiff, thus leaving for consideration here, claims numbered 5, 6, 9, 10, 11, 12, 14, 15, 16, 18, 19, 22, 23 and 24. Of these claims numbers 5, 9, 23 and 24 were refused on the ground that plaintiff's application as originally filed in the patent office did not support them.

The court has given consideration to the contention that the application failed to disclose the invention as set forth in the claims last referred to, and is of the opinion that the application as originally filed supports such claims. The specification of a patent is intended for those skilled in the art to which it relates, and if the disclosure makes the invention clear to one so skilled it is sufficient. *Thos. A. Edison, Inc. v. Watterbury Battery Co.*, 281 Fed. 254, aff. 287 Fed. 320. The testimony of Dr. Pickard, an expert witness on behalf of the plaintiff, leaves no doubt that the disclosure of the original application meets this requirement.

A more serious question arises as to whether or not the claims, including those rejected for failure to disclose, are patentable over the prior art as exemplified by the following patents: Fortescue, 1,259,385, March 12, 1918; Thordarson, 1,288,751, Dec. 24, 1918; Randall, 1,129,521, Feb. 23, 1915.

The Fortescue patent discloses a suspension insulator of the same type as that disclosed by plaintiff. It includes a series of insulating bodies 13 connected in series by means of members 11 and 5, and shield members 16 and 18 at the ends of the series for the purpose of shielding the lowest one of the insulated bodies 14 from excessive voltage drop, the arrangement being such as to insure a uniform distribution of potential among the units of the string.

Thordarson also shows electrostatic shields 15 and 30 applied to an insulator 19.

The Randall patent, cited as a reference by the Patent Office, shows a conductor with an enlarged rounded edge such as shown at 11 in the patent, for the purpose of preventing premature discharge. The Randall specification at page 1, lines 95 to 98, states that "the lower edge of the cap

shield 10 is provided with a rounded rim 11, which avoids concentration of stress upon this portion of the shield."

Fortescue and the plaintiff were dealing with the same problem and found the same solution. This is fully confirmed by the former's specification as follows:

"My invention comprises a system of condensers connected in series relation to enhance the insulating properties of which it is highly desirable to obtain uniform divisions of potential difference between the elements 5. In order to increase the insulation strength of my insulator, the external electrostatic field surrounding the same should be so distributed as to insure a substantially uniform surface distribution of the electrostatic stresses imposed thereupon. For this purpose, I have provided an upper conducting member 15 having a conducting extension 16 of discoidal shape and a lower conducting member 13 having a conducting extension 18 of discoidal shape.

"It is desirable, for maximum efficiency, and in order that my improved insulator may be of minimum length, that the external electrostatic field be substantially uniform and agree with the division of potential between the individual elements 5 comprised in the structure 4. The electrodes 16 and 18 are provided to approximate the result which would be obtained by bounding the insulating support 4 by infinite parallel conducting planes perpendicular to the axis of the insulator. As above mentioned, this will effect a substantially uniform distribution of the electrostatic field external to, and surrounding, the insulator

14 4. The condition for uniform distribution of potential among the elements 5 is that the fluxes leaving the electrodes 8 shall be of like value; this means that the capacitance of each electrode 8 to ground must be inversely as its potential, and that the capacitance between adjacent pairs of electrodes must be uniform. This is approximated very closely if the parallel plane surfaces of the flux distributing surfaces of the upper or low-potential electrode 15 and the lower or high-potential electrode 3 coincide with or lie in the planes of, the lower edges of the electrodes 16 and 18, respectively. An insulator made according to the above plan conforms to the law of uniform fields, and is insured against concentrations of electrostatic stresses upon its surfaces."

The Fessenden specification states that the applicant "was led to invent a new type of insulator, consisting of a string of small capacity insulators in series with each other.
* * * ,,"

"Still further pursuing his researches, applicant found that on account of the uneven distribution of the lines of force in strings of such insulators, there was a tendency for the first insulator in the string to break down before the others, owing to the excessive strain on that insulator; and that when this occurred, the excessive strain was transferred to the next, so that they all broke down, one after the other, like a pack of cards falling down."

" * * *

"Applicant discovered that this could be overcome by putting stress equalizing means, in the form of shields in the neighborhood of the insulators whereby the stresses could be equalized and the insulators would break down substantially simultaneously when the maxim voltage designed to be stood thereby is exceeded."

For the purpose of considering the rejection of the claims as unpatentable over the references, the claims may be divided into the following groups:

Group I. Claims 5, 6, 15, 16, 18, 19 and 24.

15 Group II. Claims 9, 10, 11, 12, 22, and 23.

Group III. Claim 14.

Claim 5 is typical of the Group I, and reads as follows:

"In high tension insulators, a conductor to be insulated, an insulator string embodying a plurality of small capacity insulators connected in series, and a potential equalizing conductor electrically connected with said conductor to be insulated and spatially related to a unit of said insulator string in immediate proximity to said conductor to be insulated, whereby said unit is relieved from undue electrical stress and such stress distributed across the units of the string, and whereby said conductor to be insulated is thereby enabled to withstand a higher voltage."

Comparing this claim with the Fortescue patent we find the conductor is shown at 1 of Fortescue. The "insulator string embodying a plurality of small capacity insulators connected in series" of the claim is also found in the Fortescue patent. There the insulators are shown at 13, and are connected by the members 11 and 5. In Fortescue the

conductor is numbered 18 and is electrically connected to the conductor 1 by means of the member 2 (p. 2, lines 78-81, Fortescue specification). The equalizing conductor of the claim which is "spatially related to a unit of said insulator string" is similar to the member 18 of Fortescue, which is spatially related to the lowermost unit 13 of the insulator string and is in immediate proximity to the conductor 1.

It is obvious from the Fortescue patent that the shield member 18 relieves the lowermost insulating element from undue electrical stress and distributes such stress across the remaining units of the string.

The claims of Group II are somewhat more specific than those of Group I in that they recite that the shield members are arranged around or surround one or more of the insulating elements.

16 The cylindrical form of the Fessenden shield whereby it may partially surround the end insulating member is a mere colorable variation of the form of the shield shown in the Fortescue patent, since the operation of both shields, is the same. Aside from this, the claims in this group are met by Fortescue in the manner pointed out in the discussion of Claim 5.

Claim 14 of Group III adds the additional limitation that the shield has a lip portion of widened cross section. The edge of the member 18 of the Fortescue patent is shown as rounded so that there is no necessity therein for an enlarged rounded portion. Furthermore, this expedient was resorted to in the Randall patent which illustrates at 11 an enlarged rounded portion.

Conclusions.

The claims as set forth in the bill are not patentable in view of the references cited, and, therefore, the bill must be dismissed.

It is so ordered.

O R LUHRING
Justice.

July 22, 1936.

Final Decree

Filed October 19, 1936

* * * * *

This cause having come on to be heard and having been
 17 tried in open court and argued by counsel for the
 respective parties upon the pleadings and proofs
 adduced and submitted to the Court,

It is ADJUDGED, ORDERED and DECREED this 19th
 day of October, 1936, that the Bill of Complaint in this case
 be, and the same hereby is dismissed with costs against the
 plaintiff.

O R LUHRING
Justice.

Approved as to form:

I R PARIS

Attorney for Plaintiff.

From the foregoing decree the Plaintiff, by the attorney,
 in open court notes an appeal to the United States Court
 of Appeals for the District of Columbia, which is hereby
 allowed; and the maximum penalty of the undertaking to be
 given as security for costs on such appeal is hereby fixed
 in the sum of \$100.00, or, in lieu thereof, a cash deposit of
 \$50.00

O R LUHRING
Justice.

Memorandum

November 9, 1936

\$50.00 cash in lieu of bond on appeal.

18

Assignments of Error

Filed January 4, 1937

* * * * *

Now comes the plaintiff in this cause and says that in
 the record and proceedings therein there is manifest error
 and that the decree entered in this cause on or about Oc-
 tober 19, 1936, is erroneous and unjust to the plaintiff; and

the plaintiff assigns for error on appeal the following matters, to wit:

1. In decreeing that the bill of complaint be dismissed, whereas the court should not have dismissed the bill of complaint.

2. In decreeing that the bill of complaint be dismissed, whereas the court should have granted the prayer of the bill of complaint.

3. In decreeing that the bill of complaint be dismissed, whereas the court should have adjudged that the plaintiff is entitled according to law to secure a patent for the improvements or invention defined in the claims of the application at bar.

4. In decreeing that the bill of complaint be dismissed, whereas the court should have held that the invention and improvements as recited in said claims are effectively and patentably distinguished from the prior art.

5. In not decreeing that a patent should issue according to law for the improvements defined in the claims in the said application.

6. In decreeing that the bill of complaint be dismissed, whereas the uncontradicted evidence presented by the plaintiff clearly established that the claims presented in the bill of complaint were patentable over the prior art as exemplified by the Fortescue patent No. 1,259,385, March 12, 1918; Thordarson No. 1,288,751, December 24, 1918; and Randall No. 1,129,521, February 23, 1915.

7. In finding that Fortescue and the plaintiff were dealing with the same problem and found the same solution, whereas the evidence presented clearly establishes the contrary.

8. In holding that claims 23 and 24 of the said application are unpatentable in view of the said prior art, whereas such claims should have been held patentable by reason of the fact that such claims were allowed by the Patent Office in patent No. 1,741,333 to Frank W. Peek, Jr., despite the fact that the said prior art was also prior art to the said Peek.

I R PARIS

Attorney for Plaintiff-Appellant.

Service of Copy of these Assignments of Error is Acknowledged this 29th day of December, 1936.

R. F. WHITEHEAD

C

Solicitor for Defendant-Appellee.

20 District Court of the United States for the
District of Columbia

Monday, January 4, 1937

The Court resumes its sessions pursuant to adjournments, the Justices sitting in Equity, presiding.

* * * * *

Come now the parties hereto by their respective counsel of record, and thereupon, the plaintiff by his attorney presents to the Court his Statement of Evidence taken at the trial of this cause, and prays that the same be signed and made of record, nunc pro tunc, which is hereby accordingly done.

O. R. LUHRING,
Justice.

Designation of Record on Appeal

Filed November 24, 1936

* * * * *

The Clerk of the Court will kindly prepare transcript of record on appeal in the above entitled case and will include therein the following:

1. Bill as amended.
2. Answer.
3. Order substituting Conway P. Coe as defendant.
4. Application as filed in the Patent Office, including drawings as filed and claims as filed.
5. Examiner's statement.
6. Decision of the Board of Appeals.
7. Decision of the Law Examiner in Interference Proceedings 55,844.
- 21 8. Decision of the Board of Appeals in Interference Proceedings 55,844.

9. Statement of evidence signed and filed including testimony of expert commencing on page 11 of the transcript of proceedings, to page 54 inclusive and first question and answer on page 56.

10. Findings of fact and conclusion by the trial justice.

11. Final decree.

12. Memorandum; Appeal noted; security for costs on appeal fixed.

13. Memorandum: Security for costs on appeal given.

14. Assignments of error.

15. The following patent references:

Fortescue No: 1,259,385; Thordarson 1,288,751;

Randall " 1,129,521; Peek No: 1,741,333:

(Printed copies of these will be supplied by plaintiff for the record.)

16. This designation.

I R PARIS

Attorney for Plaintiff.

Service of the foregoing designation of record and receipt of copy thereof, acknowledged this 24th day of November 1936.

R. F. WHITEHEAD

C.

Attorney for Defendant.

22 District Court of the United States for the District of Columbia.

UNITED STATES OF AMERICA,
District of Columbia. ss:

I, Charles E. Stewart, Clerk of the District Court of the United States for the District of Columbia, hereby certify the foregoing pages numbered from 1 to 21, both inclusive, to be a true and correct transcript of the record, according to directions of counsel herein filed, copy of which is made part of this transcript, in cause No. 54193 in Equity, wherein Reginald A. Fessenden is Plaintiff and Thomas E. Robertson, Commissioner of Patents, is Defendant, as the same remains upon the files and of record in said Court.

IN TESTIMONY WHEREOF, I hereunto subscribe my name and affix the seal of said Court, at the City of Washington, in said District, this 18th day of January, 1937.

C E STEWART

(Seal)

Clerk.

23 Endorsed: United States Court of Appeals for the
District of Columbia Filed Feb 23 1937 Moncure
Burke, Clerk.

In the District Court of the United States for the
District of Columbia

No. 54,193 In Equity

REGINALD A. FESSENDEN, *Plaintff*,

vs.

CONWAY P. COE, Commissioner of Patents, *Defendant*.

Statement of Evidence and Stipulation

At the hearing of the above entitled cause, beginning on Wednesday, January 29, 1936, before Associate Justice Oscar R. Luhring, sitting in Equity Division No. 3, the following proceedings were had and evidence offered on behalf of the parties hereto:—

The following defendant's exhibits were received by the Court:

Defendant's Exhibit 1. Folder containing the following:

A. Patent to Fortescue No. 1,259,385, Dated March 12, 1918.

B. Patent to Thordarson No. 1,288,751, Dated December 24, 1918.

C. Patent to Randall No. 1,129,521, Dated February 23, 1915.

D. Prints of Drawings of Fessenden Application.

E. Examiner's Statement.

F. Decision of Board of Appeals.

G. Decision of Law Examiner in Intf. No. 55,844, Fessenden v. Peek.

H. Decision of Board of Appeals in Intf. No. 55,844, Fessenden v. Peek.

24 Defendant's Exhibit 2. Certified copy of specification and drawing of Fessenden application, as originally filed in the Patent Office.

The following plaintiff's exhibits were received by the Court:

Plaintiff's Exhibit 1. Record of plaintiff's application.

Plaintiff's Exhibit 2. Record of Interference No. 55,844, Fessenden v. Peek, and involving the plaintiff's application in suit.

Plaintiff's Exhibit 3. Two sheets from Dictionary of Electrical Engineering.

Plaintiff further introduced expert testimony of Greenleaf Whittier Pickard.

The following is hereby stipulated by and between the parties to this cause:

1. That Reginald A. Fessenden duly filed a patent application in the United States Patent Office as set forth in paragraph 4 of the bill of complaint, and that this application was duly prosecuted in the United States Patent Office.

2. That in the course of the prosecution of said patent application the Examiner cited the following prior patents and rejected certain claims, as unpatentable thereover:

Fortescue	1,259,385	Mar. 12, 1918
Thordarson	1,288,751	Dec. 24, 1918
Randall	1,129,521	Feb. 23, 1915.

25 3. That thereafter the Examiner allowed claims 23 and 24 as patentable over the said prior patents, and declared interference No. 55,844, between the said application of Reginald A. Fessenden and an application of Frank W. Peek, Jr., on the said allowed claims 23 and 24.

4. That upon motion by the party Peek the Law Examiner held that the disclosure of the Fessenden application does not support the counts of the interference, now claims 23 and 24, and ordered the interference dissolved.

5. That the said decision of the Law Examiner was sustained by the Board of Appeals and the interference was thereupon dissolved without testimony being taken on the question of priority of invention.

6. That there being no further appeals from the Board of Appeals, the ex parte prosecution of the said Fessenden application was then resumed before the Primary Examiner, who, after proceedings before him, finally rejected the application, including all of the claims as set forth in the plaintiff's bill of complaint as amended.

7. That an appeal was thereupon filed to the Board of Appeals, the latter, after hearing, substantially affirming the Examiner's final rejection.

8. That the said Peek application issued as Patent No. 1,741,333 on December 31, 1929, containing amongst others claims 1 and 5 which are identical with the said claims 23 and 24.

9. That at the hearing before Associate Justice
26 Oscar R. Luhring the testimony of expert Greenleaf Whittier Pickard was presented by the plaintiff on the issue of the sufficiency of the disclosure of the invention in the application as filed to warrant claims 5, 9, 23, and 24 and on the issue of the patentability of claims 5, 6, 9, 10, 11, 12, 14, 15, 16, 18, 19, 22, 23, and 24 over the prior patents.

10. That the issue of the sufficiency of the disclosure was decided by the Court favorably to the plaintiff and the issue of patentability of the claims over the said prior patents was decided by the Court adversely to the plaintiff.

11. That the testimony of the expert Greenleaf Whittier Pickard on these issues commences on page 11 of the transcript of proceedings and continues through the re-direct examination on page 56, these pages being hereby made part of the present statement and stipulation.

12. That the defendant hereby consents to the immediate approval of the present statement of evidence and stipulation by the Court and hereby waives the period allowed by the rules in which to make objections or present amendments thereto.

I. R. PARIS

Attorney for Plaintiff-Appellant.

R. F. WHITEHEAD

C

Solicitor for Defendant-Appellee.

27 In order that the present statement of evidence and stipulation may be preserved and made of record, the same is hereby approved and signed and ordered to be made of record in the above entitled cause this 4th day of January, 1937.

By the Court

O. R. LUHRING

Justice.

28 In the District Court of the United States for
the District of Columbia

No. 54,193, In Equity.

REGINALD A. FESSENDEN, *Plaintiff.*

vs.

CONWAY P. COE, Commissioner of Patents, *Defendant.*

It is stipulated that the following hereto annexed and referred to in the statement of evidence shall be deemed as a part of this statement of evidence.

I. R. PARIS

Attorney for Plaintiff-Appellant.

R. F. WHITEHEAD

C

Solicitor for Defendant-Appellee.

29 *Evidence on behalf of the plaintiff.*

Whereupon—**Greenleaf Whittier Pickard** was called as a witness on behalf of the plaintiff and, being first duly sworn, testified as follows:

Direct Examination

By Mr. Wolf:

Q. Will you state to the court the experience you have had in electrical matters, particularly high-tension lines, and the experience you have also had in patent matters and matters of this nature? A. My academic training in
30 the electrical art was at Harvard University and Massachusetts Institute of Technology. While still in college I commenced summer work, my researches in

radio communication. That was in 1898. Since that time I have been actively engaged principally in the field of radio communication, and for the past 33 years I have frequently given testimony in patent and other cases involving electrical matters.

I am a member of a number of engineering societies, such as the Institute of Radio Engineers, of which I am past President and a Fellow; the American Institute of Electrical Engineers, of which I am a Fellow; and a number of other engineering and technical societies.

In 1902 I entered the employ of the American Telephone & Telegraph Company, their engineering offices, which were then located in Boston, being my headquarters, and I remained with them for four years, that is, until 1906. During that time I had responsible charge, among other things, of high tension protection of telephone circuits, and in following out my duties I made many theoretical and field investigations of high tension protection which involved incidentally not merely protective apparatus, such as fuses and arresters, but also various forms of high tension insulators.

From 1907 to the present date I have been consulting engineer, specializing, as I have already stated, in radio communication.

Q. Were you familiar with the work which the inventor in this case was engaged in? A. I was very familiar indeed with Professor Fessenden and his work. I first met

31 Professor Fessenden in the summer of 1904, and my acquaintance and contact with him was practically continuous from then until the time of his death. I was a frequent visitor at his station and laboratory at Brant Rock, Massachusetts, beginning early in 1906, and also a frequent visitor at his later home at Chestnut Hill, Massachusetts.

Q. You have heard my short description of this invention? A. I have.

Q. Were you familiar with the particular development and work of Professor Fessenden? A. I was.

Q. Would you tell the court about the circumstances and the invention itself, as you knew it, in this application? A. The circumstances were as follows: During one of my

visits to Professor Fessenden at Brant Rock, Massachusetts, in the late fall or early winter of 1906, I observed that the guys supporting the tower used for radio communication had in them certain insulating structures. These structures were of a different type from any which had been familiar to me up to that time, and I asked Professor Fessenden for an explanation, which he gave. Later, I think sometime in 1907, Professor Fessenden gave me a photograph of the Brant Rock station which shows in sufficient detail the insulators which I have mentioned. These insulators consisting, briefly, of porcelain or similar insulating material for the insulator, and in addition having certain metallic structures partially enclosing one end of the string of insulators and acting, as Professor Fessenden

32 then explained to me, as a shield to distribute the potential or, rather, to minimize the excessive potential developed at the end of the string.

The Court. Can you point that out to me on this sketch?

The Witness. That structure which I mentioned, surrounding one end of the insulator string, is the structure 18 in Figure 2, and in Figure 1 it has the two structures, 17, surrounding the two ends of the insulator string. I refer to 13, 13, 13 in Figure 1 and in Figure 2 to 14, 14, 14.

The Court. And what is this (indicating on drawing)?

The Witness. That indicates additional insulators. It is the typical draftsman's convention for a structure which repeats, where there might be perhaps five or six of these and it is sufficient to show only two of the structures, and that gap indicates that more go in.

The Court. You know what we have been talking about, of course, Mr. Cochran?

Mr. Cochran. Yes, your Honor. I have followed it here with my own drawing.

By Mr. Wolf:

Q. By the way: you showed me a photograph that Professor Fessenden gave you at the time, did you not? A. Yes; I have that photograph here in a bound album, and although the photograph is not in itself dated, the album is arranged chronologically; that is, the various photographs which I have inserted are in several cases dated, and I find that the photographs in this album run from 1905 to

1911, and that the photograph of the Brant Rock station to which I have referred comes between the photographs dated in May, 1908, preceding, and 1909, following. So that
33 this photograph was pasted in the album some time between those dates, that is, some time between 1908 and 1909. I cannot place the date more accurately.

The photograph itself shows the Brant Rock station consisting of a steel tower some 420 feet high, supported on an insulated base which is not shown because of the building in the foreground, and having a guy system to support it against collapse, which is shown rather faintly in the photograph except as to the insulators.

The Court. Those specks here (indicating)?

The Witness. Yes, sir; those specks are the insulators, and the wires composing the guys are too small to show in this photograph. There were, however, four sets of guys in four groups, the groups being disposed circularly around the tower, and the four sets of guys within the group running first from a point near the top of the tower to the ground to one of the outer guys; then from a point one third of the way down to the next, and so on. The insulators which I have mentioned are shown at two places as the hooded structures at the four points along the tower and as the dot-like point on the photograph, in the guys. The actual structure of the larger insulating members attached to the tower consisted of metallic cylinders shown as the structures descending at an angle of about 45 degrees on the lower one, and having inside and projecting, although not well shown in this photograph because of the scale, a string of insulators similar to the insulators in the guys themselves, of which there were some five or six, a similar
34 string but of smaller dimensions. That is, they consisted of a string of insulated members with a shield partially surrounding one end of the string.

The Court. The purpose of the guys was to prevent the collapse of the tower?

The Witness. Yes, sir.

The Court. Are the ones shown by these dots of the same type as these (indicating)?

The Witness. They were insulators. The object of those insulators in the guys was to break up the guys electrically. The guys, in the absence of such insulators, would become

long continuous conductors and as such would interfere with the operation of radio transmission. That is, they would absorb energy just the way a receiving antenna would absorb it, and being in such close proximity they would pick up too much energy so that it would interfere with the efficiency of the station. So, as was common practice at that time, the guys were broken by these insulators so as to make the lengths of wire in the guy continuous lengths of wire too short to absorb a serious amount of energy.

By Mr. Wolf:

Q. Did Professor Fessenden at that time or earlier explain the voltage that was necessary to insulate these towers? A. Yes. Professor Fessenden explained to me the tower used by the transmitter operating at that time in the Brant Rock station and the voltage developed on the tower, and that voltage varied from a matter of 400,000 or 500,000 up to and even over a million volts.

The Court. Would that have anything to do with
35 the power of 500,000 watts, or whatever it was?

The Witness. Yes.

The Court. Are those terms synonymous?

The Witness. Voltage is not synonymous with power, but it is one element. To use a familiar hydraulic analogy, one may have 100 pounds pressure in a water main, and that in itself does not represent power; but if at the same time a hundred gallons per minute were flowing in the water main at 100 pounds pressure, that would represent available pressure. Power is the product of the current and the voltage or potential. So in the case of a radio station the higher the power the higher the voltage on the antenna or radiating tower, other things being equal.

By Mr. Wolf:

Q. Is not this the same problem as high tension insulation of transmission lines? A. It is exactly the same problem with the added complication of a higher frequency. In radio transmission the frequencies are much higher than those used in power transmission. Power transmission, for example, is normally at 60 cycles or less per second. Radio transmission is at some tens of thousands per second up to over a million cycles per second; and owing to the higher

frequency of radio transmission the effects tending to break down insulators and cause heating and other losses in insulating structures are much greater. Also in the early days, that is, in 1906, the types of transmitter used in radio developed voltages very much in excess of any then used or even contemplated on power transmission lines.

36 Q. How did they compare with the power used now in radio? A. The picture has changed. In power transmission we are already transmitting potentials of 100,000 and 200,000 volts. We have experimental transmission lines of considerable length which have withstood potentials of over a million volts, and in the not too far distant future we are looking forward to transmission at 1 million volts as a commercial matter.

Q. Have you read the original Fessenden specification?

A. I have.

Q. Will you explain to the court, please, what that application discloses and how the invention is to operate?

The Court. Is that what I have here before me now?

Mr. Cochran. Defendant's Exhibit 2, your Honor.

A. The Fessenden application, as has already been stated, is for an improvement in high tension insulators; that is, insulators for voltages measured in tens of thousands or hundreds of thousands of volts as contrasted with the insulators used at much lower voltages, that is, those ranging from 100 to a few thousands.

The form taken by Fessenden's improved high tension insulator is shown in Figures 1 and 2 of the application and described in the specification forming a part of this application. Referring, now, to Figures 1 and 2 of the drawings, it will be seen that the insulator consists of a string of insulating members, 13 in Figure 1 and 14 in Figure 2.

There was nothing novel in such a string at the time of Fessenden's application, and this string of insulators by itself is not Fessenden's invention herein.

37 In addition to the string of insulators, metallic or conducting members, 17 in Figure 1 and 18 in Figure 2, are arranged so as to partially enclose or surround the string of insulating structures. The object of these conducting members and their disposition is to change the distribution of current so that the field or strain is distributed more uniformly over the string of insulators and so that each insu-

lator in the string is made to carry its proper load. The field existing between two separated charged bodies, such, for example, as a high tension high transmission line on the one hand and ground on the other, while invisible, takes the form or shape of the familiar field between the poles of a magnet, which may be made evident by iron filings, as every schoolboy knows. That is, it consists of a concentration of lines of force or field at the magnet poles which spreads out, becomes less dense, that is, in the space between.

So, referring to Figure 1, if we were to remove the metallic elements or shields, 17, and were to impress a higher difference of potential of voltage between the metal or conducting terminals, 12-12, we would have a field in space around the insulators, 13, which would be concentrated at the end structures, right and left in the drawing, and would be diffused or weaker in the space surrounding and passing through the ones in the middle. That would mean that the end structures would be subjected to a greater difference in potential than the middle insulating structures, and so would be more apt to fail or break down or "flash
38 over", as the technical phrase is. The same of course is true in the structure shown in Figure 2, which is merely a different form.

The specification states, as I have already shown, that the problem was one of insulating voltages much higher than had been used in practice, and that those voltages might run up to 1 million volts. The specification also states that the voltages then in use for transmission purposes were about 50,000. These statements in the specification, page 1, lines 16 to 18, were, as I know from my own experience and knowledge as of that time, conservative; that is, the voltages which were actually developed in radio transmission were a million volts or higher at that time, and the voltages used for power transmission purposes were, as Fessenden states, 50,000, or in general lower. Thirty-three thousand volts at that time was quite a common upper limit. Only a few lines in 1905 and 1906 were operating at higher potentials.

The specification goes on to point out the disadvantages of the insulators then used for power transmission purposes. They were, as the specification states, large, heavy and, what was often worse, such insulators had a high elec-

trical capacity. An insulator interposed between two conductors, that is, line and ground, for example, acts as an electrical condenser. When the potential rises between the two conductors, that is, the ground and the high tension line, what we call a charging current flows into or through the insulator. The higher the capacity of the insulator viewed as a condenser the greater is this charging current, and this charging current is a load upon the line. It is current that has to be supplied from the power transmission line, which represents, therefore, a loss in two ways: first, it increases the line current and, hence, the resistance losses on the line; secondly, owing to the fact that all insulators are imperfect—that is, when they are subjected to an alternating field heat is developed in the insulator due to what we call dielectric losses—the net result of the dielectric loss or the loss in the insulator and the increased rate on the line is to lower the efficiency of the power transmission. That means that if you are transmitting a hundred kilowatts over a certain distance you might be expending an undue portion of that power in overcoming line losses, and that of course is a direct loss to the power transmission company.

That effect, as I have already pointed out, is accentuated at the higher frequencies of radio transmission. The charging current in the insulator becomes much greater, in fact, in direct proportion to the increase in frequency, so that, as the specification states at page 1, lines 19 to 21, many of the insulators then in common use for power transmission would not only have weighed over a ton, but the charging current would have used up all the power available. In damp weather, of course, the volume of moisture that forms on the surface of the insulator is the cause of an additional loss of power due to leakage over the surface of the insulator.

I now come to—

The Court. We will stop for lunch, now, if you are going on to another subject.

40 (Whereupon, at 12:30 o'clock p. m., a recess was taken until 1:30 o'clock p. m., of the same day.)

After Recess.

The court reconvened at 1:30 o'clock p. m., at the expiration of the recess.

Mr. Wolf. If your Honor please, I am going to ask the witness to continue with his description of the invention and the operation of it as disclosed in the application.

The Court. Yes. Go ahead. Is the record in the interference proceeding here also?

Mr. Wolf. Yes, your Honor; I have submitted that.

The Court. Proceed.

Whereupon—

Greenleaf Whittier Pickard, the witness under examination at the time of the taking of the recess, resumed the stand and testified further as follows:

Direct Examination—Resumed

The Witness. The specification of the Fessenden application goes on to state that, owing to the high capacity and large size of the standard insulators he was led to invent (page 1, line 30) a new type consisting of a string of small capacity insulators in series with each other. That, as I have already stated, is no part of the invention herein; that is, the small capacity type of string insulators in themselves; but it is an element of the new insulator.

Coming now to the invention, of the application, on page 2, lines 4 to 9, inclusive, the application states that
41 on account of the uneven distribution of the lines of force—that is, the electric field—in strings of insulators there was a tendency for the first insulator in the string to break down before the others, owing to the excessive strain on the insulator, and when this occurred the excessive strain was transferred to the next, and so on, so that they broke down successively, as the application states, like a pack of cards falling down.

Continuing (lines 10 to 13), that this defect in a string of high tension insulators could be overcome, that is, the stresses could be equalized by using shields in the neighborhood of the insulators. These shields are the elements 17-17 in Figure 1 of the drawings, and the element 18 in Figure 2.

The specification continues (line 14), that the shape of these shields can be calculated mathematically and also can

be determined experimentally; and its states (page 2, line 20) that in most cases it is sufficient and easier to determine the shape experimentally. I may say that I heartily agree with that part of the specification, because the mathematical determination of such a shield is not a simple matter. It involves a rather considerable knowledge of mathematics, spherical harmonics, to be specific; and in most cases it is easier to determine the shape experimentally, that is, by a rapid cut and try process, putting on a shield, finding out what effect it has on the breakdown of the insulators in the string, and then moving it or changing its size until no one insulator shows a tendency to fail or break down before another.

42 The shields in Figure 1, that is the element 17, in order to function in the manner stated, that is, to distribute the flux, are connected to the points of opposite potential, that is, the ground on the one side and the high tension line or high tension body to be insulated on the other.

At this point I think it is important to state that it makes no difference whether we consider the ground to be a point of low potential and the line a point of high potential, or vice versa, because so far as the string of insulators to be protected is concerned it is merely a question of the voltage existing between the ends of the string. It does not matter which end is ground unless the insulator string is placed quite near the ground, within a few feet of the ground. In practice it is never so placed. It is always, in the case of a transmission line, up on top of a pole; so that in the structures shown in these two figures, it is a matter of absolute indifference electrically and for the question of protection of the string of insulators inside the shield, which is ground or which is line for the two terminals or ends of the string.

This is stated in the specification, page 2, lines 23 to 25, where the support is at ground potential in Figure 1, and in Figure 2, potential of line; and the applicant correctly states that it is not essential, as either support may be a ground potential or line potential.

By Mr. Wolf:

Q. May I interrupt to ask a question there, Doctor Pickard? Do you understand from the specification that the

line may be connected to this shield or to this shield
43 (indicating)?

A. The specification states with respect to Figure 1 (line 23) that the support, (11)—that is, the support for the member 12 shown at the extreme left hand side of the figure—is considered as being at ground potential, and it goes on to state that in Figure 2 this same support (11) is at line potential, although it is a matter of indifference whether it is at line potential or at ground potential, so far as the operation of the protective means is concerned. That is, the shield or shields.

Q. Does it also state in the specification that those potentials may be reversed? A. It does. That is, lines 24 and 25 state that it may be reversed, the language being, “though it is not essential as inter-support may be ground potential or line potential.”

The Court. One is higher than the other? Is that the idea?

The Witness. One is higher, your Honor, with respect to things outside the string of insulators. With respect to the string of insulators it is a purely relative matter. One end of the string may be ground, yet as viewed from the other end of the string it is high potential. We are merely concerned with the voltage existing across the string, and the effect of the voltage in breaking down the insulators is not in any way conditioned on which end of the string is connected to ground and which end is connected to line.

The specification continues with an explanation of the details of the construction of the electro-static shields
44 in line 29, page 2. The electro-static shields, 17-17, of Figure 1 are described as taking the form of rings, or circular torus section; that is, doughnut shape or anchor rings, which, referring to Figure 1 of the drawings of circular section portions, show the ring of the element 17, and the E-shape portion is a support for the ring. That support may of course take any form. It may be made a solid cup-shape piece of metal, or it may take the form of a spider, somewhat similar to the spider in the familiar steering-wheel of an automobile, which supports the rim of the steering wheel.

The operative part of the shield, 17, in Figure 1, so far as the protection of the insulator string inside is concerned, is

the rings shown at the right hand side of the left hand Figure 17 support and the left hand side of the right hand Figure 17 shield, because the electro-static field produced by these shields is principally centered upon the adjacent ring terminals of these shields. There is no important part of the field coming from the support or the ring. Similarly, in Figure 2, the edge of the cylindrical cam shield, 18, is shown as permissibly rounded as at 19; and the specification states at page 3, lines 2 and 3, that the applicant has experimentally found that it is sometimes advantageous to attach a rounded edge, as in 19; and the reason for that is this. At high potentials the sharp edge or point tends to form a corona or glow-like discharge due to the high concentration of field at that point. That is, it tends to ionize the air in its neighborhood, and that is often disadvantageous. If the edge is rounded, such corona or break-down effects in the air are minimized. That is very well

45 known in the art and has been since the days of Benjamin Franklin, that a point will cause a discharge, whereas a rounded or spherical or ring-like surface will not.

The specification then continues with an explanation of the matter upon which I have just touched, namely, the effect known as corona or glow or brush discharge.

Q. Seeing that that does not form a part of the claim, I do not think you need to go into that part of the specification. Perhaps it would be well to have you consider as a sample the claims that were in the interference proceeding, and show how those claims apply to this structure that has been described by you here. Take Claim 23, which was the first claim in the interference proceedings. A. Claim 23 reads, "A string of more than two interconnected insulating units adapted to support an electrical conductor."

That first element of the claim refers to the string of insulators shown in Figure 1 of the application as the elements 13 and in Figure 2 as the elements 14.

"Said string being provided with electro-static flux controlling means conductively connected to the conductor and proportioned and situated around the insulating units so as to substantially compensate directly for the leakage of electro-static flux of the string whereby uniform voltage distribution results."

That last element of the claim refers to the element 17-17 of Figure 1 and the element 18 of Figure 2. These elements are conductively connected to the line and ground in Figure 1; that is, the elements 17 are conductively connected to the members 12, which are the line and ground terminals of the string, and in Figure 2 the single shield, 18, is shown as connected to the element 15 which is one terminal of the insulator string. The claim states that these electro-static flux controlling means are so proportioned and situated about the insulating units as to compensate for the leakage of electro-static flux of the string. That proportioning and positioning is shown clearly in the figures. In Figure 1 the diameter of the ring as shown is considerably larger than the diameter of the insulators which are to be shielded. Also the elements 17 are shown as partially enclosing the end insulators of the string. Those two things—that is, the size and the positioning of the elements 17—result in an approximately uniform electro-static field across the insulator string. In a similar manner the positioning of the element or shield 18 in Figure 2, which is shown as almost completely enclosing two of the end elements of an indefinitely long string, acts to promote the end insulator or insulators of this string; that is, the insulators which would normally be subject to the greatest potential, and therefore would be the most liable to break down.

Q. Will you explain the expression “so as to compensate directly for the leakage”? A. The expression “so as to compensate directly” means this, that the distorted field, the undesirably distorted field, which would have existed across the insulator string—that is, that field that I have already described as concentrated on and through the end insulators—is now directly, by the single agency of the shields, straightened out so that the strain across each one of the insulators is made substantially the same as across any other one of the insulator elements.

Q. Do you consider that the next claim, No. 24, is similarly shown in the description of the application? A. I do. Claim 24 states the matter in somewhat different language; that is all. In Claim 23 the shields are described as compensating directly for the leakage of electro-static flux of the string, whereas in Claim 24 the shields or the conduct-

ing members are described as proportioned and located in the electro-static field adjacent to the line end of said string to supply directly to each unit a capacitance current substantially equal to the capacitance current in units of ground. That is just another way of stating what Claim 23 recited. Electro-static flux of the string is the same thing as a capacitance current. A current through a dialectric is not the same thing as current through a conductor. That is what we call a displacement current that is not directly carried by a conducting member. It is carried through space, air, or a dialectric, and it is a matter of flux.

Mr. Wolf. Before considering the other claims in the application—I am trying to shorten up the case if possible—I am going to ask Dr. Pickard to consider the references cited in the Patent Office on the next phase of the case, that those claims are not allowable over references. There are
48 two points to consider: one, whether the application discloses the invention, as we claim it does, and, second, whether the claims are patentable over the references that were cited.

The Court. You said you were going to dismiss some of these claims. Why do we not get that settled here?

Mr. Wolf. I am going to dismiss the matter with regard to claims 7, 8, 13, 17, 20 and 21. The others I believe are allowable.

The Court. With reference to the six that you dismiss, they were denied, I suppose, in the Patent Office?

Mr. Wolf. Yes, your Honor.

The Court. And the remaining ones also were denied?

Mr. Wolf. Yes, sir.

Mr. Cochran. All were denied.

The Court (addressing the witness). Is this exclusively adapted to radio purposes, or could it be adapted to any high power line?

The Witness. It is adapted, your Honor, to any case where it is desired to support and insulate a high-tension conductor or any other conductor. It may be ground or something that has a different potential; and that applies equally to radio antennas, high tension transmission lines, or, in fact, anything whatsoever which is of high potential and which must be supported and insulated. There are numberless cases where in the electrical art you might wish

to even support a heavy structure such as a dynamo on a tower on an insulator. It is not infrequently done. It was done at Brant Rock in the case of that 420-foot steel tower.

49 It supported and insulated the steel tower from the ground. So the thing is of general application; that is, wherever it is desired to support and insulate; that is, a combination of a mechanical and electrical matter it is useful for.

The Court. It is only indicated, however, in very high tension voltages?

The Witness. Yes, sir; that is, voltages in general of well over 10,000 volts. Under 10,000 volts these troubles, such as breakages of insulators in a string, are either non-existent or are so rare that it is not worth considering.

By Mr. Wolf:

Q. The Patent Office has cited the Fortesque patent No. 1,259,385, and the Randall patent, No. 1,129,521. I am going to take those two patents together, because they are associated together in structure, and I am going to ask you, Dr. Pickard, to explain what is disclosed in these two patents. A. I will take up the Randall patent first. This patent is for a single insulator. It is not for a string of insulators, but for a single insulator in which, by reason of a metallic shield and a certain shaping of the insulator member the tendency for the insulator to arc over the surface, that is, break down by a discharge across the surface of the insulator, is minimized. This is done in the manner shown diagrammatically in the figures. It will be noted that each one of the figures of the Randall patent, 1, 2 and 3, show on the right hand side an empty space; that is, the insulator is cut away between the metal and member 5 and the inner element 2 in Figure 1, and the metal pole, 10, and the inner element 8 in Figure 2; and similarly in the space
50 between the element 16 and the inner element 17 in Figure 3.

In this space is shown, in broken line in each of the figures, the electro-static field or flux or lines of strain which would exist if the inner element were at a different potential of voltage to the outer element. That is, if there existed a difference of voltage between them, that field is shown correctly as being a number of more or less curved lines,

and if we look at the outer or lower curved line we will see that its curve is substantially the same as the curve which is given to the insulating member shown in black at the left hand side. The object of that, as the Randall patent states, is to produce an electro-static field or strain in the air on the surface of the insulator which is parallel with the surface of the insulator when the insulator is placed in a position which does not disturb the normal field which existed before it was placed there, and the full insulating value of the lower surface of that insulator can be obtained.

There is no question at all of the utility and value of this Randall patent. It does precisely what it claims. It has value for a single insulator, and so in itself is not relevant to the Fessenden application in which two or more insulators in series or in a string are specified.

Coming to the Fortesque patent, a string of the identical insulators shown in the Randall patent, their identity being sufficiently shown by a comparison of the figures of Randall and Fortesque as shown in the single figure in the Fortesque patent. In addition to this string of Randall insulators, end

51 structures 16 and 18, shown in the single figure of the Fortesque patent, are added to the string. The conjoint action of these end members 16 and 18 and the individual shields or metallic portions of the Randall insulators are shown at 15 and 5 in the upper two members of the string.

The Court. You mean that 15 in the Fortesque patent is similar to 5 in the Randall patent?

The Witness. Yes, sir. It is the same shaped member, your Honor.

The Court: Yes; I see.

The Witness. I do not find on the third insulator a designated number for that shield, but the shield is shown as of the same character as the two upper ones. Through the conjoint action of the members 16 and 18 in these metallic shields, the members of the Randall insulators between the voltage acting across each one of the insulator units is equalized. This equalization results from the combined action of the end shields or members 16 and 18, and, as I have said, these inner elements—

By Mr. Wolf:

Q. May I interrupt one moment to ask you to point out this. Are the shields over the insulators metallic elements?

A. They are metallic elements; that is, they are conducting elements.

The Court. Are they encased?

The Witness. They are practically encased, your Honor. They are shown as conical or funnel shape metal members, and they enclose the greater part of the insulator inside.

The only part that is in any way exposed is the lower
52 face of each insulator.

The Fortesque arrangement differs from that arrangement shown and claimed in the Fessenden application in two ways. In the first place, the equalization of strain on the separate insulator units of Fortesque is not accomplished directly by the end shields or elements 16-18. It is accomplished, if at all, indirectly; that is, by the conjoint action of these shields, 16 and 18, and the smaller or individual insulator shields.

Secondly, the Fortesque insulator elements are elements of high capacity. They are of high capacity because the insulators with the metal members form condensers, and condensers in which the metal or conducting armatures or plates of the condenser are relatively of large area and of relatively small separation through the dielectric or insulator. So in consequence this type of insulator would have a high charging current when used on a power transmission line, and a still higher charging current or displacement current through the string when used at the higher frequencies of radio.

By Mr. Wolf:

Q. Do you know whether or not the type of insulator shown in the Fortesque patent is generally applied or used at the present time in high tension insulators? A. I have never seen the Fortesque arrangement such as is shown in the figure of the Fortesque patent, in commercial use. I do not know that it ever has been so used. All of the insulators
53 which I have seen equipped with end shields are simply strain insulators of the Fessenden type, low-capacity elements.

Q. There is one other reference cited, the Thordarson patent. Would you kindly distinguish that for the court from the Fessenden application? A. Thordarson shows, in Figure 1, a rope insulator, shown at 19-19, for supporting an element of a high tension transmission line. This rope is described in the specification at page 2, lines 30 to 32, as a rope saturated with tar or other water-proofing or insulating material. This rope insulator is equipped at each end with conducting members 15-15 and 30-30, which act as shields to minimize the concentration of electro-static flux or strain at the ends of this rope; the specification stating, page 2, lines 34 to 37, that at the higher potentials it becomes necessary in order to avoid burning the rope at its point of anchorage with the line, to provide a special construction, in the nature of a protector or shield at the part of the rope where it is secured to the high tension line.

The difference between Thordarson and the Fessenden application is that there is but a single insulator, namely, a piece of tar-saturated rope. It does not have a string of insulator units called for in the Fessenden application claims.

Q. Considering the other claim in the Fessenden application, have you read Claim 5? A. I have.

Q. Do you consider that distinguishable over the references you have just discussed? A. I do.

Q. In what way? Would you kindly point that out
54 to the court? A. Claim 5 recites as its first element an insulator string embodying a plurality of small-capacity insulators connected in series.

Referring, now, to Fortesque, we have a string of high capacity insulator elements connected in series.

Referring to Randall, we do not have a plurality of insulators in series at all; neither do we have a plurality of insulators in series in Thordarson. It is not necessary, therefore, to go beyond the first element in Claim 5 to distinguish it from the references.

Q. What element in Claim 6 distinguishes it from the references? A. The similar element, that of an insulator string embodying a plurality of insulator units.

Q. Does the next element also help to distinguish it from the references? A. In Claim 6 the second element is potential equalizing means for distributing electrical stress over the insulator units of said string. In Randall and Thordar-

son there are no insulator units; there is merely an insulator unit. In Fortesque the potential equalizing means does not distribute the electrical stress over the insulator units of the string. It distributes it, first, across the shields, and from there it is transferred across the units; which, in my opinion, is a different thing.

The Court. Was that the specification of Fortesque that you were reading from?

55 The Witness. No, your Honor. I was reading from the claim interpreting that, or, rather, attempting to show a difference between that claimed element and what is disclosed in Fortesque.

The Court. It was your Claim 6?

The Witness. Yes, sir; Fessenden's Claim 6.

By Mr. Wolf:

Q. In Claim 9 what are the distinguishing features over the references? A. They are in general the same, namely, the first element is an insulator string embodying a plurality of insulator units which distinguishes it, as I have already stated, from the Randall and Thordarson patents, and the potential equalizing conductor which is described in Claim 9 as a conductor of substantially circular cross section in electrical connection with the conductor and arranged around at least an end insulator of the string. Reference to Fortesque will show that neither element 16 nor element 18 is of substantially circular cross section. The lower element 18, for example, is a disk-shaped member with a rounded edge. One could not say that that had a circular cross section; neither could one say that the upper element of Fortesque, element 16, was a ring of substantial cross section.

Mr. Cochran. May I interrupt to ask which claim you are referring to now?

The Witness. I am on Claim 9.

Mr. Cochran. I do not find that statement in the claim, about circular cross section.

The Court. Your Claim 9, page 4 of the bill.

56 Mr. Cochran. There seems to be confusion as to numbering.

The Court. You will find it on page 4 of the bill, Claim 9. Have you a copy of the bill?

Mr. Cochran. Yes; that is right. But there seems to be some difference of opinion as to—

The Court. The Claims are alleged and set out.

Mr. Cochran. I do not think it makes much difference, your Honor.

The Court. Perhaps not, but we at least ought to be able to agree on what claims are before me.

Mr. Wolf. These are in the bill.

Mr. Cochran. The Patent Office made no objection to your claim in the bill. We will let it go just as it is in the bill.

Mr. Wolf. I will be glad to adjust it with Mr. Cochran. I did not want to put anything into the bill that had not been considered by the Patent Office. If it did get in there, it got in there inadvertently.

The Court. There is no reason why you could not amend this bill, if you cared to do it, in order to make it square with the claims that have been denied over there. You can do that at any time. Have you a copy of the claim?

Mr. Cochran. Yes; I have a copy of the original application.

The Court. Can you follow the witness on this so-called claim 9 here?

Mr. Cochran. Yes, sir; I can, from a copy of the bill.

The Court. Proceed.

57 By Mr. Wolf:

Q. Now, suppose we consider Claim 10 in the same manner. What have you to say as to that? A. I should say for Claim 10 what I have already said for Claim 9. Inasmuch as Claim 10 calls for a plurality of insulator units, that eliminates from our consideration Randall and Thordarson, and Fortesque similarly is eliminated, because he does not have a conductor of substantially circular cross section.

The Court. You say the difference is that this one has a plurality and the others do not?

The Witness. Yes, sir.

The Court. How about the Fortesque claim?

The Witness. That has a plurality but does not have the second element of the claims, namely, a conductor of substantially circular cross section. It does not have that. It does have a plurality of insulator units, yes; but does not have the other claimed element.

By Mr. Wolf:

Q. With regard to Claim 11, what would you say as to that? A. There, again, the first element claimed is a series of insulator units which are not found in Randall or Thor-darson; and the second element of Claim 11 is that there are potential equalizing devices operating to distribute the electrical stress throughout the series of units.

Now, referring to Fortesque, the flux is not distributed throughout the series. It is a step-by-step matter. The distribution by the shields 16 and 18 is not on the surfaces or through the insulators themselves directly; it is, 58 first, to the opposed faces of the inner shields acting in conjunction with the end shields 16 and 18. The potential is not uniformly distributed or adjusted or equalized in Fortesque across the string of insulators themselves. It is adjusted step by step across these inner shields.

The Court. Does he prevent the collapse of the outer insulator and thus a progressive collapse of all of them?

The Witness. He would get that result because he does state in the specification and show in the drawing a means of adjusting the potential across these units as a whole, so that the end units in Fortesque bear approximately the same strain or have the same voltage across them as the inner units.

The Court. In the instant patent it arrived at that result in what way? Just tell me that again, please.

The Witness. Fessenden reaches that result directly, namely, by equalizing the field or distributing the electrical strain uniformly across every part of the insulator string; so that referring to the insulator string in Fessenden, the field outside of and through the insulators themselves is made equal at all points. In Fortesque the equalization is not across the entire line or at all points.

The Court. At the same time?

The Witness. At the same time. It is step by step; that is, across each of these metal units first. Then the voltage is transferred to the insulator itself. In Fortesque it requires the conjoint action of the end shields and the inner shields, whereas in Fessenden the end shields do the whole work.

59 By Mr. Wolf:

Q. Would you kindly explain to the court the advantage of the Fessenden system over the Fortesque system? A. The advantage is two-fold. First, a simpler structure; second, and perhaps most important, a low capacity form of insulator. By the very nature of the construction of the Fortesque units, they are units of high capacity; they draw high charging currents from the high tension line to which they are connected and so increase losses in the line. It is an undesirable form because it is in the end an energy-wasting or power-wasting form as contrasted with the Fessenden form.

Q. Can you give a comparison of the expense of the two types of insulation? A. I have made no calculation, but I can see on inspection that it would be much more expensive to construct the Fortesque type than the Fessenden type.

The Court. More expensive?

The Witness. Perhaps twice as expensive to make.

The Court. Is this being used commercially to any extent?

The Witness. The Fortesque is not. I have never seen the Fortesque type in use anywhere on any power transmission circuit or at any radio transmitter.

My Mr. Wolf:

Q. Has the Fessenden type been used? A. Very widely indeed. I have seen that in numberless cases of transmission lines in the last few decades, two decades, anyway.

The Court: Has this been in use at all, this patent
60 that you have these claims on?

Mr. Wolf. This patent was applied for in 1922.

The Court: Thirteen years ago?

Mr. Wolf. So it is quite a ways back.

The Court. This identical patent?

Mr. Wolf. Yes, sir.

The Court. What has been the trouble? Does it take that long to get a patent?

Mr. Wolf. It was in interference and it went up to the Board of Appeals twice, and that procedure took up quite a long time, and we have been trying to get it before the

court here for quite some time. As a matter of fact, the Peek patent was only issued in 1929.

By Mr. Wolf:

Q. I think I have asked you to consider Claim 11. If you will kindly consider that. A. Claim 11 may be considered similar to the preceding claims 9 and 10. Its first element is a series of insulator units, which eliminates from our consideration the Randall and Thordarson references, and its second element is a potential equalizing device—

Q. Is that with reference to Claim 12? A. Oh. You said, Claim 11. I had already considered 11.

In Claim 12 the first element is an insulator embodying a series of insulator units of the same specific inductive capacity. That of course eliminates from our consideration Randall and Thordarson, which are for single
61 units and not for a series. With reference to Fortesque, the second element of Claim 12, potential equalizing means for distributing the electrical stress with substantial uniformity throughout the series of units, it certainly eliminates Fortesque, because it is a step-by-step equalizing of the potential in Fortesque, not with substantial uniformity across the whole string of units.

Q. Claim 14. We are skipping Claim 13.

The Court. That is getting pretty close to Fortesque, that Claim 12, is it not?

The Witness. The language of the first part, yes, an insulator embodying a series of insulator units of the same inductive capacity.

The Court. Is there not some uniformity of distribution of that stress? He may be going around Robin Hood's barn to do it, but he does do it, does he not?

The Witness. Uniformity, yes, with respect to the separate steps. That is, the potential existing across each unit of the insulator or, referring to Fortesque's figure, across the successive inner shields. That is not the same thing, in my opinion, as a uniform distribution of stress across all parts of an insulator string, although, as is of course obvious, it accomplishes a similar result, namely, that the end insulator of the string can be prevented from a breakdown by this equalizing means.

By Mr. Wolf:

Q. Now will you consider Claim 14, please? A. Claim 14, like the one preceding, has for its first element an
62 insulator embodying a series of insulator units, which of course eliminates the references of Randall and Thordarson for single insulator units. The second part of this claim is for an electro-static shield of annular form surrounding at least a part of said insulator, said shield having a lip portion of widened cross section. There is nothing of that sort in Fortesque. The lip portion, which would be the edge portion of 16 and 18, is not widened. That widening appears in the figures of Fessenden application 1 and 2 and is shown without number as part of the element 17 in Figure 1 and by the numbered element 19 in Figure 2.

Q. Would you just point out in Claim 15 the distinction over the Fortesque patent? A. Claim 15 has for its second element means for electro-statically distributing the normally excessive electrical stress from the point of high tension at or near one end of the insulator string across the units of the string. I do not find that in Fortesque. Fortesque does not electro-statically distribute across the units. He distributes, so far as the shield 16 and 18 is concerned, across the inner metal shields.

Q. Does that same distinction apply to Claim 16? A. It does.

Q. In consideration of claims 18 and 19, which appear to be somewhat alike, can you point out the distinction over the Fortesque patent? A. 18 and 19 have substantially the same second element as in the claim which I have just considered, namely, Claim 16; that is, means of electro-
63 statically distributing the normally excessive electrical stress across the units of the string. As stated for Claim 16, Fortesque does not distribute across the insulators. He distributes across the insulator shields.

The Court. Will you explain that term "electro-statically distributing" so that I will understand it?

The Witness. Electro-static of course means electricity at rest. That is a condition of affairs existing between charged bodies. That is what we call the electro-static field. It is used perhaps in a somewhat strained sense where the

field is operating and the field is not really at rest for any length of time, but we will say for the moment that we are considering it as at rest, and it is therefore an electro-static field, a stationary field. It is, as explained before, something like a magnetic field in the space, the ether, or whatever is between the two charged bodies, which results in imaginary curved lines of stress. I say "imaginary" because they have no visible existence, although if we place light particles in an electro-static field they will line themselves up along curved lines, which we say are the lines of force in the electro-static field.

By Mr. Wolf:

Q. Claim 22 is the only claim yet to be considered. Will you point out the distinction of that claim over the Fortesque patent? A. The distinction in Claim 22 over Fortesque is in the matter of electro-statically distributing the electric stress across the units of the string. As I have pointed out in the preceding claims, Fortesque does not distribute the strain across the insulators themselves. Instead
64 it is distributed across the shields.

Q. I just want to ask one question. Having read the Fessenden patent, and as an individual skilled in the art, do you consider that some one skilled in the art could construct and operate the invention in the manner described in the claims? A. I should say from my general knowledge of people skilled in the art, that any one coming under that description could do so. I myself certainly have no difficulty in understanding and constructing an insulator such as is disclosed in the Fessenden application.

Mr. Wolf. That is all. You may inquire.

Cross examination

By Mr. Cochran:

Q. Doctor Pickard, is it or is it not true that string insulators of the general type shown here, and without shields, were well known many years before this application was filed? A. Yes. They were known for a number of years. I would not want to say offhand, but I think at least ten years back, or probably more. I myself used string insulators ten years prior to 1922.

Q. Although this application was filed fourteen years ago yesterday, still several years before that this type of insulator, namely, the string insulator, was well known? A. The string insulator itself, either singly or in strings, was quite well known.

65 Q. Was it also known that the insulator of the string nearest the power line was subject to greater drop in voltage than the others of the string? A. Yes; that was quite well known. I knew it myself, and I believe that others knew it prior to that date. We knew it as the result, of course, of actual failure of insulators.

Q. As I recall your testimony, you stated that it made no difference whether one end of the string was connected to the pole, we will say, namely, the ground, and the other one connected to the power line; that because of the voltage drop or the rise in the voltage was the same either way, it made no difference which end would be considered as grounded. Am I right in that? A. I made that statement with only this qualification, namely, that the insulator to be considered was at a distance from the ground, and that is a large distance as compared with its own length. Of course if the insulator string were near the ground, only a few feet off the ground, the field around or through the insulator would be modified, depending on which end were connected to ground; but in its normal position I said, as I recall my direct testimony, that is, where it is up on the pole somewhere high above ground, it makes no difference at all.

Q. Is it not true that in such a situation as you last mentioned the strain on the insulator which is connected with the power line is much greater than on the other insulators of the line, even the one at the other end of the string of insulators? A. Where the string is near the ground?

66 Q. Where it is supported on a pole or a tower. A.

No; that would not be so except in the case—and you see my difficulty in giving anything approaching a categorical answer there—only in the case where the grounded end, the members comprising the grounded end had a larger area than the member or members comprising the high tension end. In that case it would make a difference, but if the two ends of the string had similar conducting terminals it would not make any difference, if it was on a pole, whether the

upper or the lower end were at high potential with respect to ground.

Q. Which end would have the most strain across the end insulator of it? A. If the two end connections, the high tension end and the ground end, were of similar construction, the tension would be equal on the two ends; the strain on the two ends would be equal.

Q. And less in the middle? A. The greatest strain would be then on the two end insulators, the top insulator and the bottom insulator in the string. If we had a larger area and the support which formed a ground at the top, that would be modified and the lower insulator in the string would have the greatest strain.

Q. Is it not generally true that the lowest insulator does have the greatest strain and that a shield about it is more necessary than about the uppermost unit of the string? A. Where it is on a steel cross-arm pole that would be measurably true, I think, because in that case the upper
67 part, that is, the ground part, would have a greater area opposed to the small area of the line terminal below, and in that case there would be more strain across the lower insulator, or the one nearest the high tension line, than across the upper insulator, which would be attached to the grounded tower, and in that case, as you say, the ring or shield would be most important at the lower or high tension end.

Q. Are you acquainted with the work of Professor Timbie, at the Massachusetts Institute of Technology? A. Yes, but only in a general way. I have not followed it in detail.

Q. I show you a book written by Professor Timbie, giving the drop in potential or in voltage across the various units of a string insulator. Is that in accordance with your understanding of the situation existing? A. Yes. If the upper tower member, which is the ground, were of large area compared with the lower or high tension line part.

Q. Is not that the conventional arrangement, that it would be of greater area? A. With steel towers, yes, I would say it would be. On other structures, such as radio antennas, with tower supports, not necessarily.

Mr. Cochran. I merely bring this to your Honor's attention to show that in what may be called the conventional installation, the drop in voltage—

The Court. Suppose you have that paragraph copied into the transcript.

(The paragraph referred to from Professor Timbie's
68 work, is as follows:)

"The strain type has advantage over the pin type in that a number of insulators are strung together in series and thus divide the total voltage of the line among several units. This is illustrated in Figures 278 and 279. Note in Figure 278 that although all the units are exactly alike, the voltage does not divide equally among them but is greater across the end units, being especially large across the unit connected to the conductor."

By Mr. Cochran:

Q. Dr. Pickard, you have stated that you are familiar with the application of Fessenden as filed in the Patent Office. Do you find anywhere in his description, that is to say, in his specification as filed, a statement that the shield members, 17 or 18, are conductively connected either to the ground or to the line? A. I do not find that in the description in those words; no. I do find it by very simple implication, however.

Q. What do you find in words in the specification which implies that? A. The first page, two lines, 10 and 11, a stress equalizing means in the form of shields. To me that means that the shields, in order to equalize stress, must be connected to something or else they would have no determined potential and would have no determinable effect upon any field which might exist. That involves, to me, a connection of the shields to something in order to produce the desired result. That is entirely irrespective of the figure of the patent which to me of course conveys the idea of connection.

Q. But that is all that you find in the specification
69 which would support that part of claims 5, 9, 23 and 24? A. Yes; and the other statements referring to the shield elements and their effect so far as equalizing strain is concerned. I do not find in words in the specification anything to the effect that they are to be connected directly with the line or ground. It does not show in as many words; no.

Q. Do you find anything in this specification as filed in the Patent Office which states, as is recited in Claim 24, that these shields supply directly to each unit a capacitance current substantially equal to the capacitance current from the unit to the ground, or do you read that statement into the specification from what Fessenden does say in his specification? A. I should say that I read that into the specification from my knowledge of the art, namely, my knowledge of the structure as is shown in the drawings of the Fessenden application and described in the application. I do not find that particular phrase in words in the specification.

Q. Concerning certain of the claims which you commented upon, which claims call for these shields having a circular cross section, is it not true that the shields in the Fortesque patent have a circular cross section? A. No. The cross section is that particular section shown in the drawing of the Fortesque patent. The shields are what we call figures of revolution, and there is a section made down through them, and the outline of that section is not circular at any point. Of course as those shields are figures of revolution they are in themselves circular in another plane; but that is not the cross-section.

Q. Is not that other plane you speak of the same plane as Fessenden has reference to in his application? A. No; I think not, because in the Fessenden application and in the drawing the cross section is shown in the same way as in the Fortesque patent drawing, and it is shown as circular—

Q. I do not think we understand each other. It seems to me that in both Fortesque's and Fessenden's drawings the sections are longitudinal sections through the string of insulators. A. Yes; that is correct.

Q. Then in neither one of them do we see any circular cross section? A. Why, I cannot agree with that. In Figure 2, for example, the numbered part of shield 18 shown in cross section is circular.

The Court. What does this indicate (showing witness drawing)?

The Witness. That is Figure 3. That refers to the method of making a conductor of a number of wires distributed around a cylinder equivalent to a solid cylinder as a conductor of high frequency current. It has no connection with the matter before us.

By Mr. Cochran:

Q. As I stated, it is my understanding that the Fortesque drawing and the Fessenden drawing show longitudinal sections of the string of insulators? A. That is correct.

71 Q. Either one of them, if you took a section at right angles to them, would have a circle shown? A. Yes.

Q. And that is the only circle shown in either case. There is no circular section shown in Figure 1 or Figure 2. I see no circle there. In order to obtain a circular section you would have to take a section through, for instance, shield 17 at right angles to the section that is shown there? A. In Figure 2, 19 is certainly a circle. That is a cross section of a ring added to the edge for thickening purposes.

Q. If you are referring only to the ring, 19. A. Yes; and equally in Figure 1. I am referring to those unnumbered portions of the element 17 which are circular in cross section.

Q. It is my understanding that the claims in question call for the shield itself to be circular in cross section, and that that is equally true of Fortesque. Refer, please, to Claim 10.

Mr. Wolf. I do not understand that that is a question. Do you want an answer to that?

The Witness. I hardly understand the question as applied to Fortesque. As applied to Claim 10 the statement is clear. It is just what I find in the drawings in the Fessenden application. In Fortesque I do not find any statement as to circular cross section.

By Mr. Cochran:

72 Q. It is true that those shields, 16 and 18, are made in circles of revolution? A. About the longitudinal axis of the insulator structure.

Q. And a cross section would be a circle? A. That is true.

Q. In Claim 10 the statement is made that there is a plurality of insulator units and a substantially imperforate potential equalizing conductor of substantially circular cross section surrounding the end unit of said insulator. Does not that statement apply, so far as circular cross section is concerned, to Fortesque, and, if not, why not? A.

Only if you consider another section than the section shown in the drawing.

Q. No particular section is specified? A. No; but if you do consider the cross section normally at right angles to the longitudinal axis, then the cross section would be circular; yes.

Q. Is not that the section which you must consider in applying the claim to Fessenden's application or Fessenden's drawing? A. I don't think so. I think in Fessenden it is the circular cross section when the cross section is made, as shown in the drawings, along the axis, and not at right angles thereto.

Q. You are still referring to the member 19? A. Either the member 17 or the member 19; yes.

Mr. Cochran. That is all.

Q. With reference to this matter of the circular cross section, Claim 10 states a conductor of substantially circular cross section; does Fortesque show a conductor of substantially circular cross section or a shield of substantially circular cross section? A. That hinges on one's definition of cross section. If it is the cross section shown in the drawings, no; he does not. You can, however, as I pointed out on cross examination, have a cross section which is circular if you choose that cross section properly, namely, at right angles to the longitudinal axis.

74

390

Defts No. 2
Def. 2

Department of Commerce
United States Patent Office

To all persons to whom these presents shall come, Greeting:

THIS IS TO CERTIFY that the annexed is a true copy from the records of this office of the Specification and Drawing, as originally filed, for use under Section 4915 of the Revised Statutes in the Supreme Court of the District of Columbia, in the matter of the Pending Application of Reginald A. Fessenden, Filed January 28, 1922, Serial Number 532,488, for Improvement in High Tension Insulators.

IN TESTIMONY WHEREOF I have hereunto set my hand and

caused the seal of the Patent Office to be affixed, at the City of Washington, this twenty-second day of January, in the year of our Lord one thousand nine hundred and thirty-six and of the Independence of the United States of America the one hundred and sixtieth.

CONWAY P. COE
Commissioner of Patents.

Attest:

D. E. WILSON
(Seal) *Chief of Division.*

75

45 aban Hill Road,
Chestnut Hill, Mass.
April 5th. 1921.

To All Whom It May Concern;

Be it known that I, Reginald A. Fessenden, a citizen of the United States, residing at Chestnut Hill, in the county of Middlesex and State of Massachusetts, have invented certain new and useful improvements in High Tension Insulators of which the following is the specification.

My invention relates to high tension insulation, and has for its object greater efficiency, reliability, increase of working voltage, and freedom from breakdown of such insulation.

Figures 1 to 5, forming a part of this specification, shew, partly diagrammatically, apparatus suitable for carrying out my invention.

Figures 1 and 2 shew means for equalizing the stresses on applicant's strings of small capacity insulators; figures 3 and 4 shew means for diminishing corona losses; and figure 5 means for clearing lines from sleet.

Applicant, between 1900 and 1905, in his wireless work, was faced with the problem of insulating voltages much higher than had been used in practice hitherto, running up to 1.000.000 volts (See Scientific American, April 30, 1921). The voltages then in use for transmission purposes were about 50.000, and the insulators were from one to two feet in diameter and weighed more than 100 lbs. Twenty of them would have weighed over a ton and the charging current would have used up all the power available in damp weather.

Applicant placed orders for suitable insulators with the

General Electric and Ohio Brass Co. but after working for a year at applicant's expense, neither had succeeded in producing an insulator which would not arc over, and neither company held out any prospect of success.

Applicant was therefore forced to undertake the development himself, and as the result of considerable mathematical and experimental work, ascertained and discovered that the difficulty with the standard insulators was that they were too large and had too much capacity to each other and to ground, and had other defects; and was led to invent a new type of insulator, consisting of a string of small capacity insulators in series with each other. This new type solved the problem, and was also used by applicant for the Ontario power transmission from Niagara Falls, applicant being sole Engineering Commissioner for the original Ontario Power Commission; thereby enabling the power lines from Niagara Falls, which were designed by applicant and constructed by applicant's assistants, to operate at much higher and more efficient voltages.

76 These insulators have since come into extended use for power transmission purposes, under the name of suspension insulators.

Still further pursuing his researches, applicant found that on account of the uneven distribution of the lines of force in strings of such insulators, there was a tendency for the first insulator in the string to break down before the others, owing to excessive strain on that insulator; and that when this occurred, the excessive strain was transferred to the next, so that they all broke down, one after the other, like a pack of cards falling down.

Applicant discovered (Scientific American, April 30th, 1921) that this could be overcome by putting stress equalizing means, in the form of shields, in the neighbourhood of the insulators, & that the stresses could be equalized and the insulators would break down substantially simultaneously.

The shape of these shields can be calculated mathematically, and in the case of the Brant Rock tower at Brant Rock, Mass. was so calculated, as experimentation would have been too difficult and expensive, and the calculation was so accurate that the insulator strings used to break down in the middle before either end, though there was only

a small percentage of difference between middle and ends, all being practically simultaneous. But in most cases it is sufficient and easier to determine the shape experimentally.

In figures 1 and 2, 11, 11 are the supports for the insulator strings; in fig. 1 the support being at ground potential, and in fig. 2 the support being at the potential of the line; though this is not essential, as either support may be at ground potential or at line potential, the full voltage or as much of it as may be designed, being across the insulator strings, 13, 13, 13, 13, and 14, 14, 14, 14.

In fig. 1, 12, 12, 12, are the connecting elements of the insulator string, and 17, 17 are the electrostatic shields, here, as shewn, in the form of rings of circular torus section, supported by the members 12, 12.

In fig. 2, 15, 15, 15, are the connecting elements, in the form of flat strips, attached to the insulator axes 20, 20, 20, 20.; as also the elements 16, 16, which are other connecting elements, also on the form of flat, but thicker and larger strips, attached to the outside of the insulators 14, 14, 14, 14. In this figure, 18, 18 is the electrical shield, as shewn, in the form of a barrel of sheet iron, surrounding the
77 insulators and attached to the connecting element adjacent to the support 11, as shewn. Applicant has experimentally found that it is sometimes advantageous to attach a rounded edge to the lip of the barrel, as at 19. The barrel also acts as a shield from snow and rain and sleet.

Applicant never put this into commercial use on the Niagara Falls power lines, as it was not necessary, but has made an extended series of tests, with entirely satisfactory results, and now proposes this method as a still more advanced method, i. e. enabling still higher voltages to be used, and diminishing the cost of insulators at the present voltages, and increasing their reliability.

Applicant has also discovered how to eliminate corona losses. As the result of considerable experimental and mathematical work, applicant discovered that a corona formed when, if a molecule of air next the conductor became disassociated and conducting, (and thereby forming in effect a projecting minute point on the conductor, and thereby changing the arrangement of the electrostatic lines in the neighbourhood of the conductor,) the differential of the electrostatic intensity with respect to distance was increased by

the new arrangement of the electrostatic lines, above what it was, substantially, previous to the disassociation, & the corona would spread; and ultimately if the voltage was high enough, there would be an arc; but if not, would merely spread till the potential slope had diminished to the disassociation point.

Applicant therefore by calculation, discovered that by making the conducting surface have a certain large curvature, depending on the arrangement of the electrostatic lines from the conductor, itself depending upon the presence or absence of neighbouring conductors, the differential value could be made to *diminish*, or at least not increase, on the occurrence of disassociation. In this way applicant was enabled to design a spark gap with large balls, (U. S. Patent No. 1,175,418; filed Feb. 2nd, 1910) which should arc over at the same voltage, whether direct current, or alternating current of 60 cycles, or 600,000 cycles; which had never been done before.

Applicant gives this theory, above, because though the use of rounded surfaces for obviating corona losses is in general use, the true reason is not yet a matter of public knowledge; and because it is necessary to the understanding of applicant's second method, hereinafter described.

78 In this second method, illustrated in fig. 3, instead of using a solid or tubular conductor of sufficiently large diameter to have the right curvature, a number of conductors, strips, or as shewn, wires 21, 21, 21, are attached, preferably by spot welding, to a ring 22, preferably of conducting material. This is somewhat similar to the arrangement shewn in applicant's U. S. Patent, 706,737; filed May 29th, 1901, but differs from it in that the wires 21, 21, 21, are carefully selected, by experiment or calculation, so that the differential of electrostatic force with respect to distance is so controlled by the spacing apart of the wires and the diameter of the hoop 22, and the size of the wires, that it will not exceed a desired value, generally one below the disassociation point; also so that, in case disassociation starts, it is preferred that the arrangement should be such that the slope in the new arrangement of lines will not be substantially increased, or will diminish. The calculations are too complicated to be given here, but the experimental determination is easy, once the principle is grasped. It will be found that there is a best size,

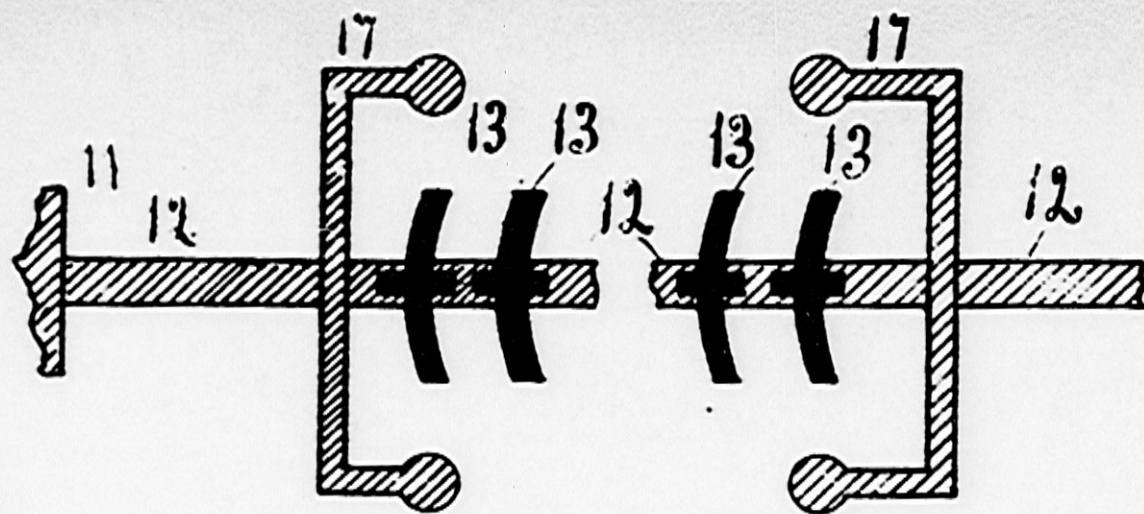


Fig 1.

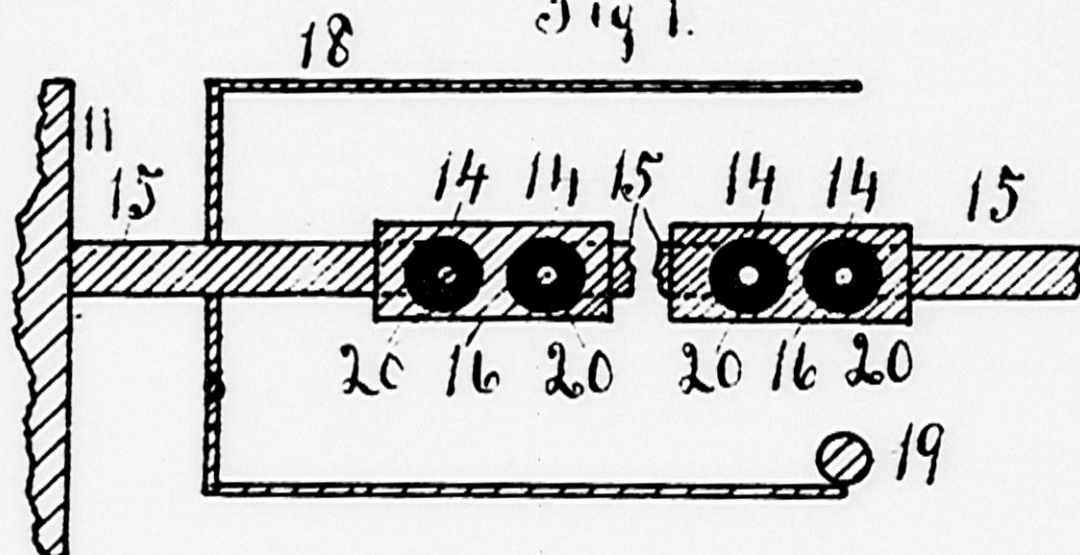


Fig 2

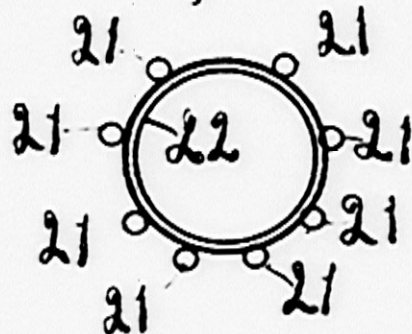
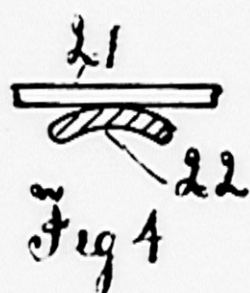


Fig 3

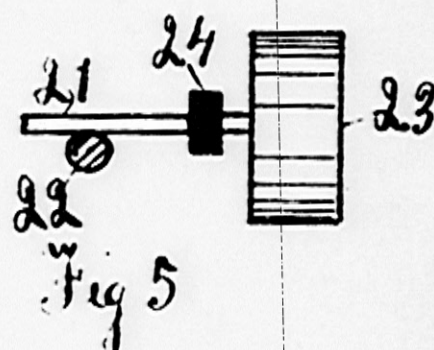


Fig 5

WITNESSES:

Charles J. F. ...
INVENTOR

BY

ATTORNEY

Fig. 1.

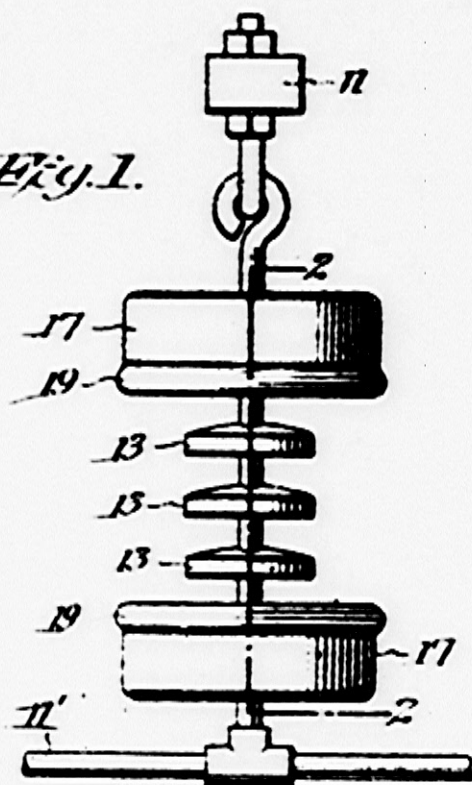


Fig. 2.

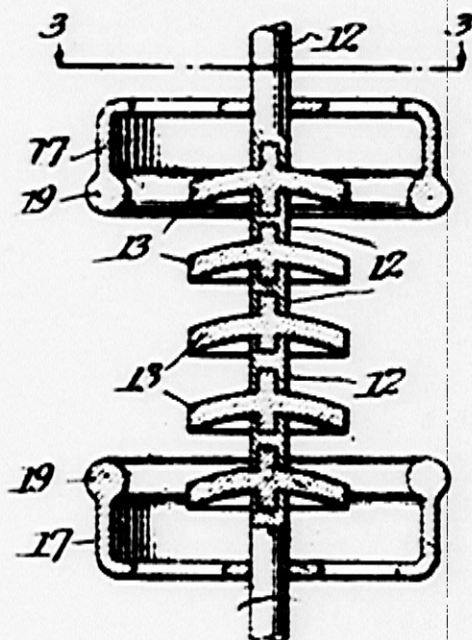


Fig. 4.

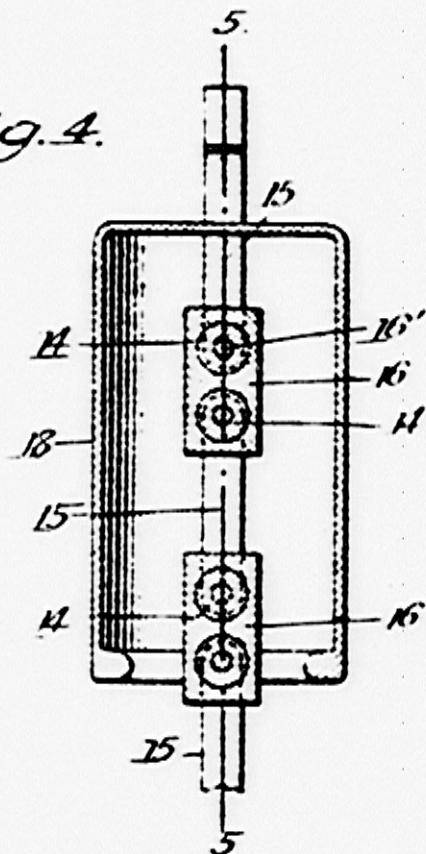


Fig. 3.

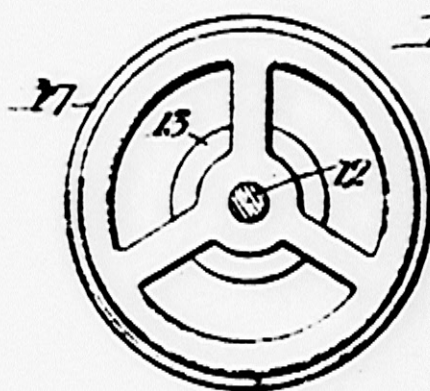
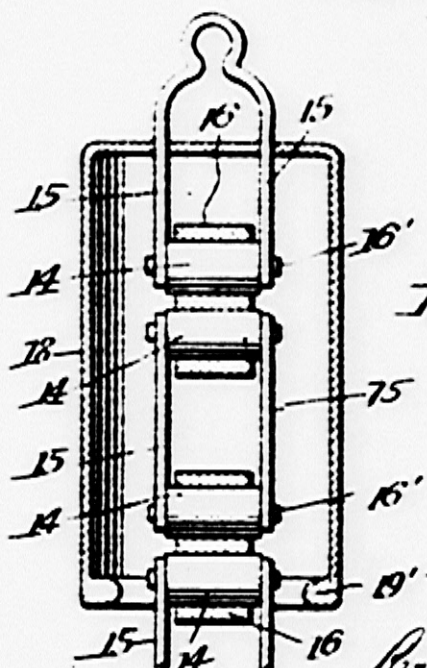


Fig. 5.



Inventor:

Reginald A. Freeman

364

Wm. Grant & Co.

Attorney

for if the size of the wires 21,21,21, is increased there will be too few of them to equalize the slope. So, if the hoop 22 be too large, they will not be sufficiently adjacent to each other to mutually modify each other's field. On that side of the hoop adjacent to other conductors, for example the ground 25, the wires should as a rule, be closer together, as shewn.

As shewn in fig. 4, it is advisable that the hoop 22 should have its section of large curvature, on its outside (i. e. large radius of curvature), & preferably the same as that of the hoop itself, though this is not necessary.

To remove sleet from the wire, applicant attaches an oscillator, (as shewn in applicant's U. S. Patent 1,167,366; filed Jan. 29th, 1913.) to the wire 21 and ring 22 by means of the insulator 24. On actuating the oscillator in the manner described in the above mentioned patent, the sleet is caused to fall off. It will be noted that the efficacy of the method is largely due to the fact that the vibrations induced in the transmission line are longitudinal and not transverse, as in the usual method, and hence travel very much further, necessitating very few vibration sets; and the vibration is much more efficient, since the displacing forces are greater and more effective.

WHAT I CLAIM IS:

79 1. In a multiple high tension insulator, a conductor in proximity thereto, whereby the electrostatic stresses across the elements of the insulator are more efficiently distributed; whereby the insulator is made more efficient for its purpose.

2. A high tension transmission line, comprising a plurality of conductors arranged on the surface of a circular figure, and said conductors so spaced relatively to each other that the maximum slope of electric potential in the medium surrounding the conductors is less than it would be if said conductors were evenly spaced.

3. The combination of an electrical transmission line and a vibrator for generating longitudinal vibrations in said line; whereby said line is maintained free from sleet and drops of moisture.

REGINALD A. FESSENDEN.

(Here follows photostats marked pages 80 and 81.)

82 Div. 54, Rm. 241A.

#30

DEPARTMENT OF COMMERCE

U. S. PATENT OFFICE

WASHINGTON, D. C.

Mailed May 10 1931

Before the Board of Appeals

On Appeal

In re application of Reginald A. Fessenden Ser. No. 532,-
488 Filed Jan. 28, 1922 For High Tension Insulators

Examiner's Statement

Applicant appeals from the final rejection of claims 5 to 24, inclusive, of the application, which are as follows:

5. In high tension insulators, a conductor to be insulated, an insulator string embodying a plurality of small capacity insulators connected in series, and a potential equalizing conductor electrically connected with said conductor to be insulated and spatially related to a unit of said insulator string in immediate proximity to said conductor to be insulated, whereby said unit is relieved from undue electrical stress and such stress distributed across the units of the string, and whereby said conductor to be insulated is thereby enabled to withstand a higher voltage.

6. In high tension insulators, a conductor to be insulated, an insulator string embodying a plurality of insulator units, and potential equalizing means in spaced relation to an end unit of the string subjected to its undue proportion of electrical stress and operative for relieving such unit of over-stress and distributing such stress over the remaining insulator units of said string.

7. In high tension insulators, a conductor to be insulated, an insulator string embodying a plurality of insulator units, and a curved potential equalizing conductor spatially disposed about at least a unit of said string concentric therewith.

Ser. No. 532,488—Appeal

83 8. In high tension insulators, a conductor to be insulated, an insulator string embodying a plurality of insulator units, and a curved electrostatic shield disposed spatially around at least one of the units of said string.

9. In high tension insulators, a conductor to be insulated, an insulator string embodying a plurality of insulator units, and a potential equalizing conductor in electrical connection with the conductor to be insulated and including a substantially imperforate portion of cylindrical form spatially surrounding at least an end insulator of the string.

10. In high tension insulators, a conductor to be insulated, an insulator embodying a plurality of insulator units, and a substantially imperforate potential equalizing conductor of substantially circular cross-section surrounding an end unit of said insulator.

11. In high tension insulators, a conductor to be insulated, an insulator embodying a series of insulator units, and curved potential equalizing shields disposed respectively spatially around the end units of the series.

12. In high tension insulators, a conductor to be insulated, an insulator embodying a series of insulator units, and a potential equalizing shield spatially surrounding at least an end unit of the insulator.

13. In high tension insulators, a conductor to be insulated, an insulator embodying a series of insulator units, and potential equalizing means spatially surrounding at least a part of said insulator.

14. In high tension insulators, a conductor to be insulated, an insulator embodying a series of insulator units, and an electrostatic shield of annular form spatially surrounding at least a part of said insulator, said shield having a lip portion of widened cross-section.

15. In high tension insulators, a conductor to be insulated, an insulator string embodying a plurality of insulator units, and means for electrostatically distributing the normally excessive electric stress from a point of high tension at or near one end of the insulator string across the units of the string.

84 16. In high tension insulators, a conductor to be insulated, an insulator string embodying a plurality of insular units, and means for electrostatically dis-

tributing the excessive electric stress from the high tension line end of the string across the units of the string.

17. In high tension insulators, a conductor to be insulated, an insulator string embodying a plurality of insulator units, and means for relieving an insulator unit of the string normally subjected by its order of arrangement in the string to an undue proportion of the electrical stress and electrostatically distributing the stress across the units of the string.

18. The method of protecting and preventing the electrical breaking down of string insulators of high tension lines, which consists in electrostatically distributing the normally excessive electric stress from a point of high tension at or near one end of the insulator string across the units of the string.

19. The method of protecting and preventing the electrical breaking down of string insulators of high tension lines, which consists in electrostatically distributing the excessive electric stress from the high tension line end of the string across the units of the string.

20. The method of protecting and preventing the electrical breaking down of string insulators of high tension lines, which consists in relieving an insulator unit of the string normally subjected by its order of arrangement in the string to an undue proportion of the electrical stress and electrostatically distributing the stress across the units of the string.

21. The method of protecting and preventing the electrical breaking down of string insulators of high tension lines, which consists in electrostatically distributing the electric stress by disposing a curved conductor so as to more or less surround at least an end unit of the string in radially spaced relation thereto.

22. The method of protecting and preventing the electrical breaking down of string insulators of high tension lines, which consists in electrostatically distributing the electric stress across the units of the string by disposing an annular conductor in radially spaced relation to the insulator and surrounding at least an end unit of said insulator.

23. A string of more than two interconnected insulating units adapted to support an electrical con-

ductor, said string being provided with electrostatic flux controlling means conductively connected to the conductor and proportioned and situated about the insulating units so as substantially to compensate directly for the leakage electrostatic flux of the string, whereby uniform voltage distribution results.

24. The combination with a line conductor, of a plurality of insulating units joined in a string by metallic connections and supporting said conductor, and a conducting member conductively connected to said line conductor and proportioned and located in the electric field adjacent the line end of said string to supply directly to each unit a capacitance current substantially equal to the capacitance current from the unit to ground.

References relied on:

Fortescue,	1,259,385, Mar. 12, 1918
Thordarson,	1,288,751, Dec. 24, 1918
Randall,	1,129,521, Feb. 23, 1915

Applicant's Disclosure

The alleged invention relates to means for equalizing the potential differences between the successive units of a string of electric insulators. As is well-known, the unit of such a string next adjacent the high tension line is, in the absence of any equalizing means, subjected to a greater electrical stress than the remaining units. Applicant proposes to remedy this defect by disposing an electrostatic shield adjacent an end of the insulator string. This shield, as shown in Fig. 1 comprises a cup-shaped member 17, concentrically mounted with respect to the insulator string. The rim of the cup 17 is thickened, as shown. Applicant alleges that such an arrangement will insure a uniform distribution of potential among the units 13 of the string. A second shield 17 is shown at the other end of the string.

Disclosure of the References

Fortescue 1,259,385 shows a string of insulators to which are attached electrostatic shields 16 and 18. These shields

are concentrically mounted with respect to the insulator string and the arrangement is described as being such as to insure a uniform distribution of potential among the units of the string.

Thordarson 1,288,751 also shows electrostatic shields 15 and 30 applied to an insulator 19.

Randall 1,129,521 shows it to be old to thicken the rim of metallic parts used in high-tension work to prevent discharges therefrom. This is shown at 11 in Fig. 2.

History of the Application

In connection with this appeal, the following history of the application should be considered. On Sept. 20, 1927 an interference (#55,844) was declared between this application and an application of Frank W. Peek, Jr. Serial 440,154, filed Jan. 26, 1921. The claims forming the counts of said Interference originated in the Peek application, and are claims 23 and 24 of the present application. A motion to dissolve, brought by the party Peek, was granted by the Law Examiner, on the grounds, 1. That the party Fessenden had no right to make the counts; and 2. that if an interpretation be given to the counts such that they may be

87 read on the disclosure of the Fessenden application, then they are anticipated by the prior art. From this decision of the Law Examiner, Fessenden appealed, but the Board of Appeals affirmed the decision. Fessenden then brought a bill in Equity under section 4915 Rev. Stat. against the assignee of the Peek application asking the U. S. District Court for the Northern District of New York to direct the Commissioner of Patents to allow the counts. This Bill was dismissed for lack of jurisdiction, the court stating that the Commissioner of Patents should have been named as defendant. The court's decision is reported in 6 U. S. Pat. Q. 1. Fessenden then resumed the prosecution of the application before the Primary Examiner, who, in accordance with the previous decisions of the Law Examiner and of the Board of Appeals rejected claims 23 and 24 (the counts of the Interference) as involving new matter not warranted by the original disclosure. The remaining claims of the applica-

tion were also rejected for reasons which will be discussed below. In response to a request for reconsideration of this rejection, the rejection was repeated and made final, and it is from this final rejection that the present appeal is taken.

The Rejection

The rejection of claims 5, 9, 23, and 24 is based on the grounds that there is no warrant in the original disclosure for the limitation that the electrostatic shield is electrically connected to the power conductor and that this limitation therefore involves new matter. This is the view taken by the Board of Appeals in its decision in the above-mentioned Interference.

88 The remaining claims do not define the shield as being electrically connected to the conductor and are therefore rejected as being drawn to an insufficiently described and apparently inoperative structure, since it is not seen that the shields will operate to equalize the distribution of potential over the insulator unless they are electrically connected to the conductors.

All the claims are further rejected on Fortescue, whose shields 16 and 18 accomplish the same purpose and are considered the full equivalent of applicant's shields 17. With respect to claim 14 which specifies a "lip-portion of widened cross-section" the Examiner's position is that no invention is involved in providing the shields of Fortescue with a thickened rim in view of Randall who shows such a thickening at 11, Fig. 2.

Respectfully submitted,

W. E. WAITE

Examiner, Div. 54

JDS/HVW

SEERS

Copy sent attorney:

EZEKIEL WOLF
160 State Street
Boston, Mass.

89

Appeal No. 1983 Paper No: 33
Decision.Endorsed U. S. Patent Office Board of Appeals Oct 29
1931 Mailed

Appeal No. 1983

kse

Hearing:
Oct. 8, 1931

In the United States Patent Office

Before the Board of Appeals

Ex parte Reginald A. Fessenden

Application for Patent filed January 28, 1922, Serial
No. 532,488, High Tension Insulators.

EZEKIEL WOLF for applicant

The applicant has appealed from the decision of the examiner denying the patentability of some twenty claims numbered 5 to 24, inclusive. Claim 24 is illustrative and is as follows:

24. The combination with a line conductor, of a plurality of insulating units joined in a string by metallic connections and supporting said conductor, and a conducting member conductively connected to said line conductor and proportioned and located in the electric field adjacent the line end of said string to supply directly to each unit a capacitance current substantially equal to the capacitance current from the unit to ground.

The references relied upon are:

Fortescue,	1,259,385,	March 12,	1918,
Thordarson,	1,288,751,	Dec. 24,	1918,
Randall,	1,129,521,	Feb. 23,	1915.

90 The claims are directed to a high tension insulator comprising the usual insulator string. The alleged novelty resides in having this string of insulators of relatively small capacity and employing a potential equalizing or electrostatic stress equalizing or distributing shield to overcome the excessive strain upon the first insulator of the string. In practice, two such stress equalizing shields may be employed in the relation indicated in Fig. 1.

The history of the progress of the instant application has been recorded in the examiner's statement and need not be here repeated. The law examiner, on the motion to dissolve filed by the patentee Peek, in interference No. 55844, held the applicant here had no sufficient basis in his application to support the claims, at present numbered 23 and 24, which were copied from the patent to Peek. On appeal to the Board of Appeals, that tribunal affirmed the holding of the law examiner. In the instant appeal the contention is vigorously made that the Board of Appeals improperly read the applicant's disclosure, and consequently incorrectly held the applicant had no right to make the claims. We are called upon to review in connection with the present appeal that former *inter partes* holding of this same tribunal. We find no necessity for considering the question

91 whether the present tribunal in its former decision in the interference was in error in its interpretation of the disclosure of the applicant. We agree with the holding of the law examiner that applicant cannot make claims 23 and 24 for the reasons set forth by that tribunal. We find also none of the claims before us on appeal patentably distinguished from the references relied upon by the examiner, of which we consider the patent to Fortescue the most pertinent. Indeed, save as to claim 14, which recites a "lip portion of widened cross-section," we find the claims clearly met in this Fortescue patent. This patentee makes it plain enough that he is able to use a suspension-type insulator which "for a given voltage, will be of smaller dimensions than has heretofore been utilized for a similar voltage." To "effect a substantially uniform distribution of the electrostatic field external to, and surrounding, the insulator 4," the patentee provides the electrodes 16 and 18. As we view the claims before us, they are clearly unpatentable.

The decision of the examiner is affirmed.

BOARD OF APPEALS.

WM A KINNAN

First Assistant Commissioner

FRANK C. SKINNER

Examiner-in-Chief

J W CLIFT

Examiner-in-Chief

October 29, 1931

92 Docket Clerk Oct 16 1928 Copy Mailed

Hearing:

55, 844-22 S E T

June 6, 1928.

In the United States Patent Office.

FESSENDEN V. PEEK.

Patent Interference No. 55,844.

Motion to Dissolve.

Motion to Amend.

Insulating Supports.

Application of Reginald A. Fessenden filed Jan. 28, 1922,
Serial No. 532,488.

Application of Frank W. Peel, Jr., filed Jan. 26, 1921, Se-
rial No. 440,154.

Mr. Ezekiel Wolf for Fessenden.

Mr. Charles E. Tullar for Peek.

The party Peek moves to dissolve on the grounds:

1. That the party Fessenden has no right to make the counts.

2. If an interpretation be given to counts 1 and 2 such that they may be read on the disclosure of the Fessenden

application, then they are anticipated by the following references:

Fortescue, No. 1,259,385, March 12, 1918,

Electrical World, published by McGraw, Hill Company, Inc., 10th Ave. and 36th Street, New York, New York, Vol. 74, page 454 (issue of August 30, 1919),

Thordarson, No. 1,288,751, Dec. 24, 1918,

Transactions of the American Institute of Electrical Engineers, published by the American Institute of Electrical Engineers, 33 W. 39th Street, New York, New York, Vol. 37, part 1, page 830.

To the patents cited in the motion may be added the patents to Koontz, No. 1,215,549, and Sonneborn, No. 1,93 291,218. There was no objection by the attorney for Fessenden to their consideration.

The party Fessenden moves to amend to include in the issue the following claims:

3. In combination with a conductor to be insulated, an insulator string comprising a plurality of insulating units connected with said conductor, and means for distributing the electrostatic stresses to the units of the insulator and relieving an insulating unit which is normally subjected to an undue proportion of the electrostatic stress, said means comprising a conductor specially disposed about the portion of the insulator string adjacent to the conductor and conductively connected with the conductor.

4. The method of protecting string insulators of high tension conductors which consists in distributing the electrostatic stresses to the units of the string and relieving an insulator unit of the string which is normally subjected to an undue proportion of the electrostatic stresses, by disposing in spaced relation about the end of the string adjacent the high tension conductor a conductor conductively connected with the high tension conductor.

5. In combination with a conductor to be insulated, an insulator string comprising a plurality of insulating units connected with said conductor, and means for distributing the electrostatic stresses to the units of the insulator and relieving an insulating unit which is normally subjected to an undue proportion of the electrostatic stress, said means comprising a conductor specially disposed about the portion of the insulator string adjacent to the conductor and

conductively connected with the conductor, and proportioned and located in the electric field for the purpose described.

6. The method of protecting string insulators of high tension conductors which consists in distributing the electrostatic stresses to the units of the string and relieving an insulator unit of the string which is normally subjected to an undue proportion of the electrostatic stresses, by disposing in spaced relation about the end of the string adjacent the high tension conductor a conductor conductively connected with the high tension conductor, and proportioned and located in the electric field for the purpose described.

The counts need not be reproduced. They appear in the declaration and in the brief on behalf of Peek.

The invention relates to means for securing a uniform distribution of potential across the units of a string of inter connected insulators used for suspending conductors carrying extremely high voltages. For the purpose stated the party Peek employs a conducting member 20 or 30 conductively connected to the cable 13. The member 20 or 30 entirely encircles one or more of the insulating units and being charged at line potential is disposed in the field about the insulating units to alter the electrostatic field so that the voltage gradient across each insulating unit may be substantially the same.

94 Consideration of Fessenden's application will be confined to the original disclosure (Cooper v. Downing, 1916 C. D. 227, 230). The party Fessenden discloses in his original application high tension insulators in the form of strings of small capacity insulators in series and means to equalize the stresses thereon. The insulators are suspension insulators and obviously intended to support and insulate a line conductor. The "line" mentioned in Fessenden's specification evidently refers to the line conductor to be supported by the insulators. The shields 17, 18, Figs. 1 and 2, are electrostatic shields. Shield 18 is definitely described as a barrel of sheet iron and shield 17 must be an electrostatic flux controlling means. The shield 17 at the left of Fig. 1 is apparently connected conductively to connecting element 12 and to support 11. No line conductor is shown in Figs. 1 and 2. It would have to be somewhere at the right

of Figs. 1 and 2, since the insulators are supported at 11 and the support is distinguished from the line. It is not certain that shield 17 at the right of Fig. 1 is *conductively connected* to a line conductor for the purpose stated in the counts and the specification makes no definite statement to that effect. Fig. 2 shows no shield at the right of the insulator string and it is not clear that two shields are to be used in Fig. 2 as in Fig. 1. It does not appear to be necessary for shield 17, Fig. 1, to be conductively connected to a line conductor to make it a stress equalizing means
95 since the two shields 17 may cooperate to distribute the electrostatic stress more uniformly across the insulator units 13.

If Fessenden cannot make count 1 he cannot make count 2 for similar reasons. There is no clear disclosure of a conducting member conductively connected to a line conductor and proportioned and located in the electric field adjacent the line end of the string to supply directly to each unit a capacitance current substantially equal to the capacitance current from the unit to ground. Count 2 is not a restatement of count 1 in other terms, but is more specific.

The counts have been held patentable to Peek by the primary examiner over the Fortescue patent which is as pertinent as other references cited in the motion. If they are construed broadly to cover any electrostatic flux controlling means for a string of insulators, they would be unpatentable. The alleged unpatentability of the counts is conditioned upon the possibility of a holding that Fessenden can make them.

The claims submitted in the motion to amend cannot be made by Fessenden for the reason stated in discussing the existing counts. They appear to be patentable over prior art. Claims 4 and 6 are not so dependent upon structure that they cease to be proper method claims. Claim 5 is not patentably distinct from claim 3. The last two lines of claim 5 add nothing substantial to claim 3. For a similar reason claim 6 is not patentably distinct from claim 4.

At the hearing it was agreed that claims 3 and 5 might be amended to insert the word *second* before "conductor" in line 9 of each claim. Such amendment should be made within twenty days, ending November 5, 1928.

The motion to dissolve is granted.

The motion to amend is denied.

A limit of appeal is set to expire November 5, 1928.

I. P. DISNEY

Law Examiner.

October 16, 1928.

97 Appeal No. 858

NLH

10

Hearing:

June 21, 1929

In the United States Patent Office

Before the Board of Appeals

FESSENDEN VS. PEEK

Patent Interference No. 55,844 between the application of Reginald A. Fessenden, filed January 28, 1922, Serial No. 532,488 and the application of Frank W. Peek, Jr., filed January 26, 1921, Serial No. 440,154. Insulating Supports.

Mr. Ezekiel Wolf for Fessenden.

Mr. Charles E. Tullar for Peek.

This is an appeal by Fessenden from a decision of the law examiner granting Peek's motion to dissolve on the ground that Fessenden has no right to make the two counts of the issue and also denying a motion by Fessenden to add four counts. Peek's motion contains a second contention that if the counts are construed to be of such scope that Fessenden can make them, then they also read on the prior art and are not allowable.

The subject matter of the present issue relates to a means-conducting grid or ring-like member to be associated with a string of high tension suspension insulators and conductively connected on the line or charged side, with the object of so distributing the electrostatic stresses as to equalize the voltage strain as between the several insulator elements of the string. This tends to

prevent the breakdown of the insulators next to the line which otherwise would be under stronger voltage stress than those farther away and the consequent break-down one by one progressively through the series. Count 1 is representative of the issue and claims numbered 3 and 4 of Fessenden's motion to amend are representative and are as follows:

1. A string of more than two interconnected insulating units adapted to support an electrical conductor, said string being provided with electrostatic flux-controlling means conductively connected to the conductor, and proportioned and situated about the insulating units so as substantially to compensate directly for the leakage electrostatic flux of the string, whereby uniform voltage distribution results.

3. In combination with a conductor to be insulated, an insulator string comprising a plurality of insulating units connected with said conductor, and means for distributing the electrostatic stresses to the units of the insulator and relieving an insulation unit which is normally subjected to an undue proportion of the electrostatic stress, said means comprising a conductor spacially disposed about the portion of the insulator string adjacent to the conductor and conductively connected with the conductor.

4. The method of protecting string insulators of high tension conductors which consists in distributing the electrostatic stresses to the units of the string and relieving an insulator unit of the string which is normally subjected to an undue proportion of the electrostatic stresses, by disposing in spaced relation about the end of the string adjacent the high tension conductor a conductor conductively connected with the high tension conductor.

99 The problem was well recognized long before either of the applications was filed and different plans had been proposed to remedy the trouble. The essential point of novelty of the counts is the arrangement of the grid at the power side of the string of insulators and with the definite limitation that it be conductively connected therewith and proportioned and situated so as to substantially compensate directly for the leakage electrostatic flux of the string.

On careful consideration of Fessenden's original disclosure we find that while it suggests among other alternative

arrangements that of having a ring grid member at the power side of the string of insulators, it fails to definitely disclose the very essential limitation that the grid must be conductively connected to the power conductor as required by each of the two counts. The disclosure as originally presented goes no farther than to specify that members 12 are connecting members for the insulator string and that the ring members 17 are broadly supported from them. It is not specified that these parts are conductive or conductively connected. Further, no power conductor except member 11 is shown and it is quite indefinite just how the insulator might be associated with such member if used as a conductor. The element marked 11, Figure 2 on the drawing, was said to be either a support or a conductor and from the specification it appeared to be considered immaterial whether the ring grid was carried at the ground side or the power side of the insulator string. Member 11 appears to be some kind of upright post or mast and cannot be identified as any type of usual conductor. It appears to resemble a radio aerial mast in which case it is not properly classified as a power conductor according to
100 common practice, and if it is such, as appears probable in Fessenden's case then the shielding member 18 of that figure is on the opposite end of the insulator string from that required in the counts. It is on the grounded end instead of on the power end. It is noted that allegation is made in Fessenden's brief that radio towers are sometimes connected into the aerial systems of antennae but that is believed to be only in some special plan not identified in their original specification or explained in this relation and is too vague to be relied on here. However as stated above the application fails to definitely disclose that the grid member is conductively connected to the conductor which is considered to be a bar to the claims constituting the issue, in the Fessenden application.

The new claims proposed by Fessenden are subject to the same ground of rejection as each includes the limitation requiring conductive connection between the grid member and the power conductor. Two of the proposed claims are in the form of method claims but they also define the above essential feature in terms of apparatus in the expression "by

disposing—a conductor conductively connected with the high tension conductor.”

It is considered that the indefinite disclosure in the Fessenden case fails to support the details of either the counts or the proposed claims. The decision of the law examiner is affirmed. The motion to dissolve is granted. The motion to amend is denied.

Board of Appeals

M J MOORE

Assistant Commissioner

EUGENE LANDERS

Examiner-in-Chief

W L REDROW

Examiner-in-Chief

September 10, 1929

(Here follow photostats marked pages 101 to 117)

Endorsed on Cover: No. 6916 Reginald A. Fessenden, Appellant, vs. Conway P. Coe, Commissioner of Patents. United States Court of Appeals for the District of Columbia Filed Feb 23 1937 Moncure Burke, Clerk

Dec. 31, 1929.

F. W. PEEK, JR
INSULATING SUPPORT

Filed Jan. 26, 1921

1,741,333

2 Sheets-Sheet 2

Fig. 5.

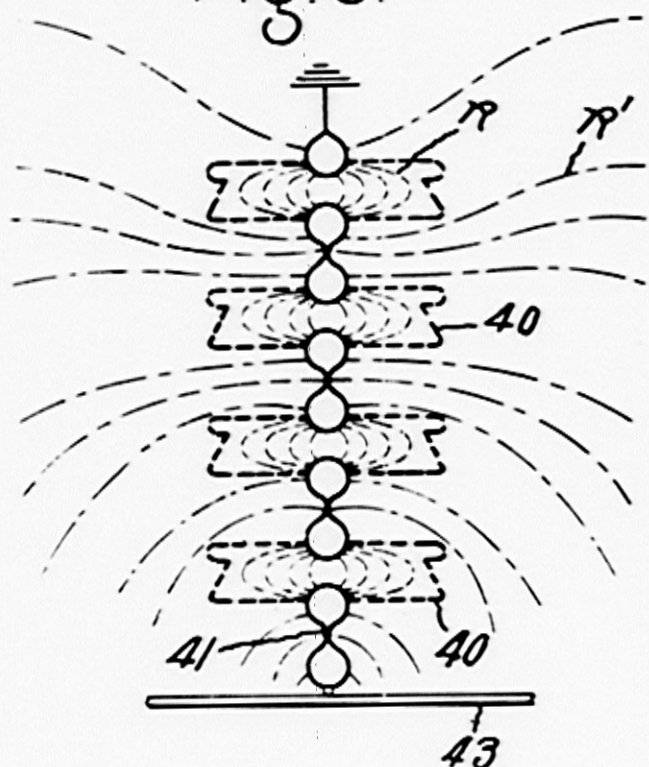


Fig. 6.

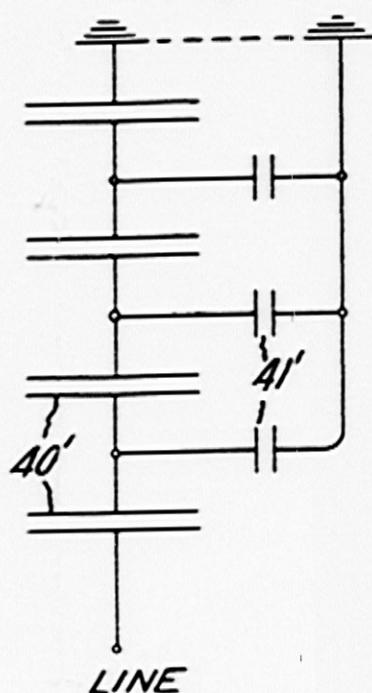


Fig. 7.

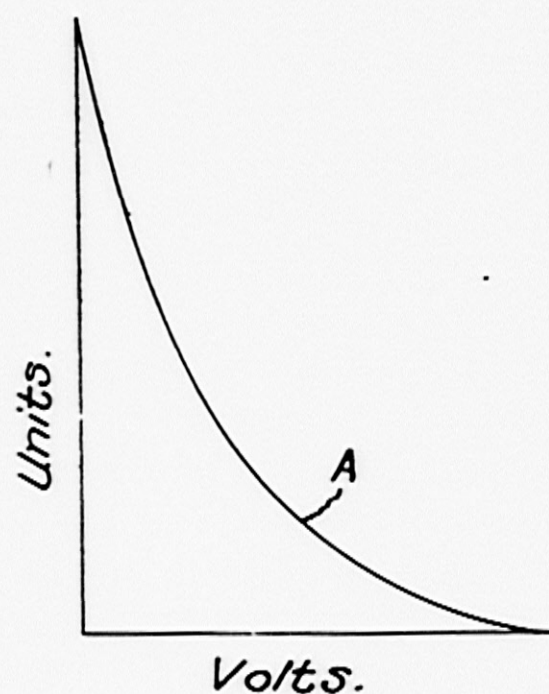


Fig. 8.

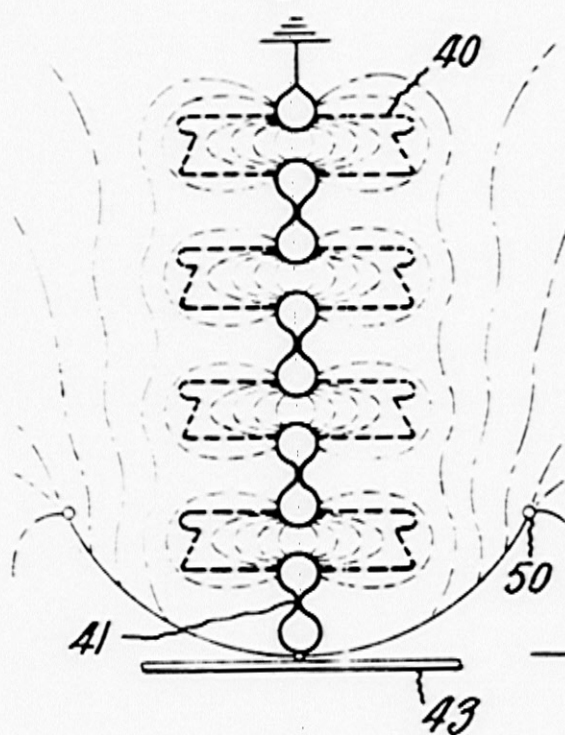


Fig. 9.

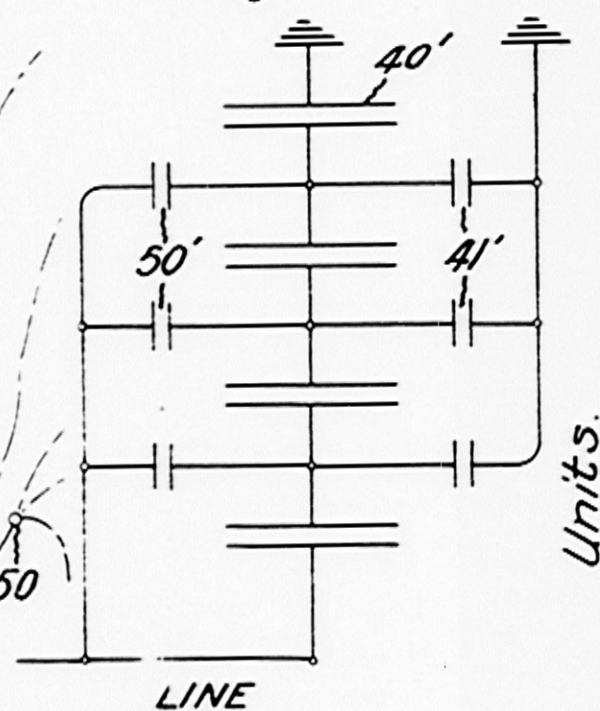


Fig. 10.

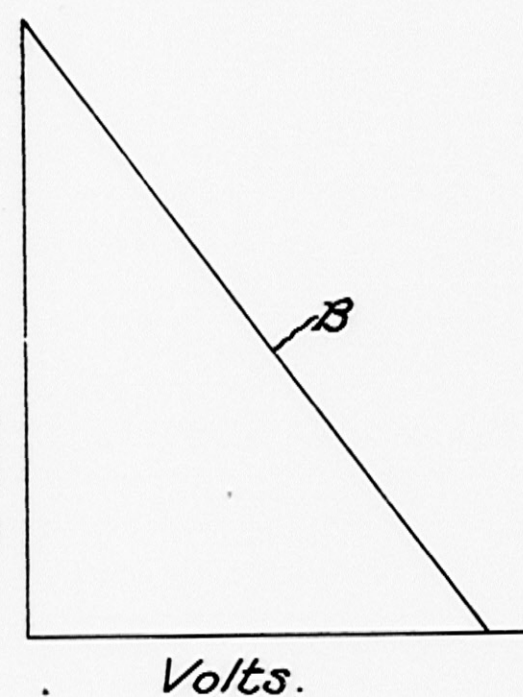
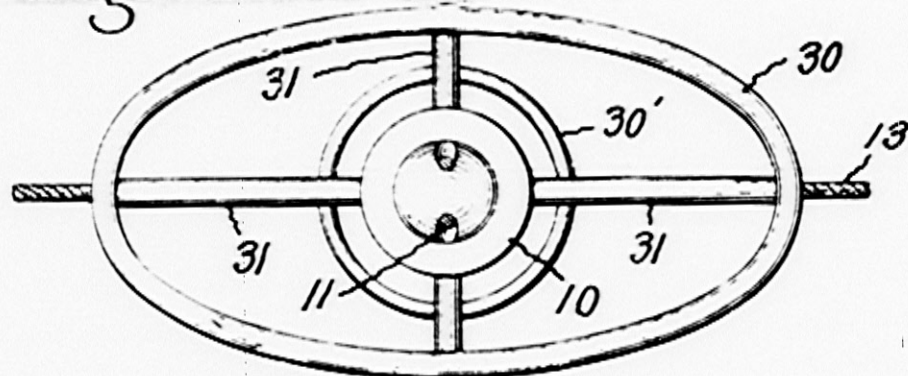


Fig. 4



Inventor:
Frank W. Peek Jr.,
by *Albert J. Dawson*
His Attorney.

Dec. 31, 1929.

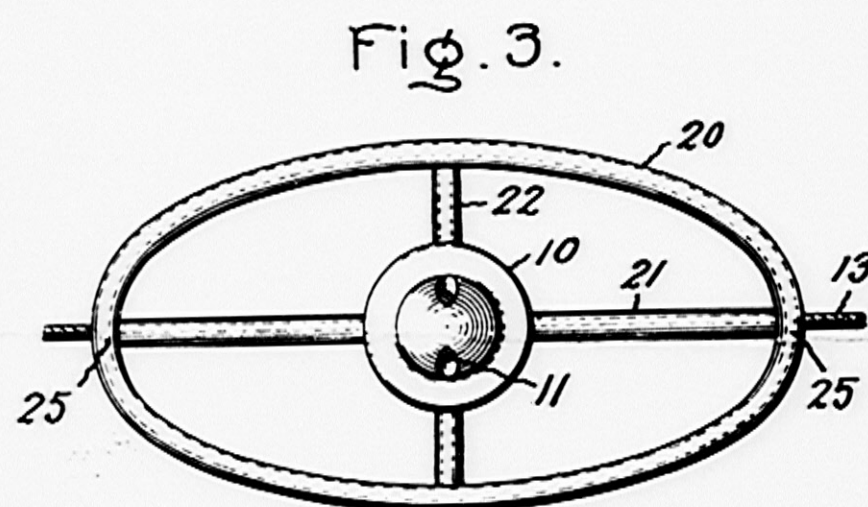
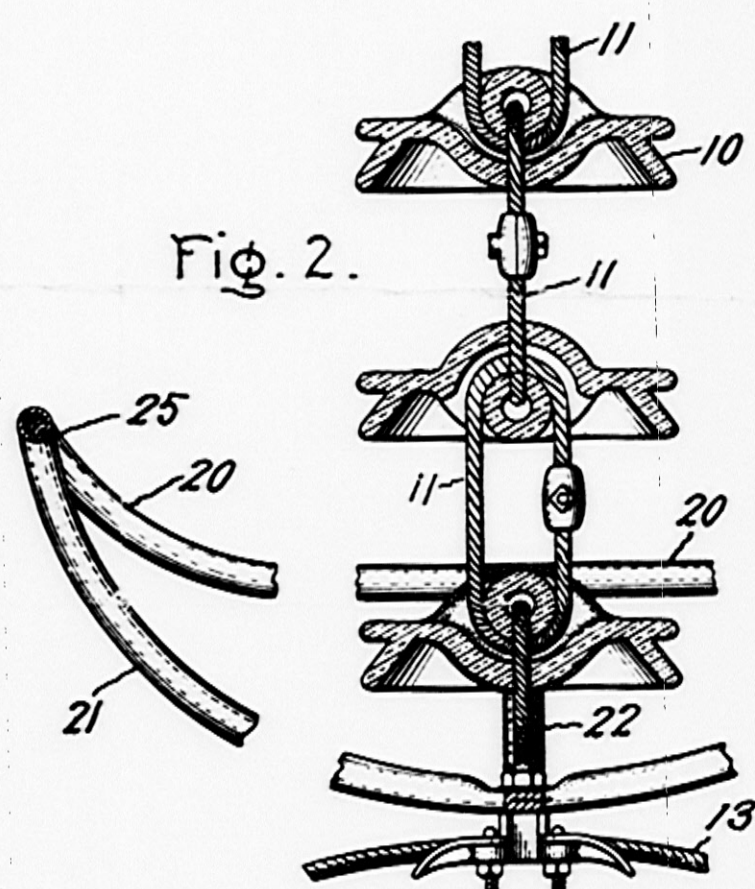
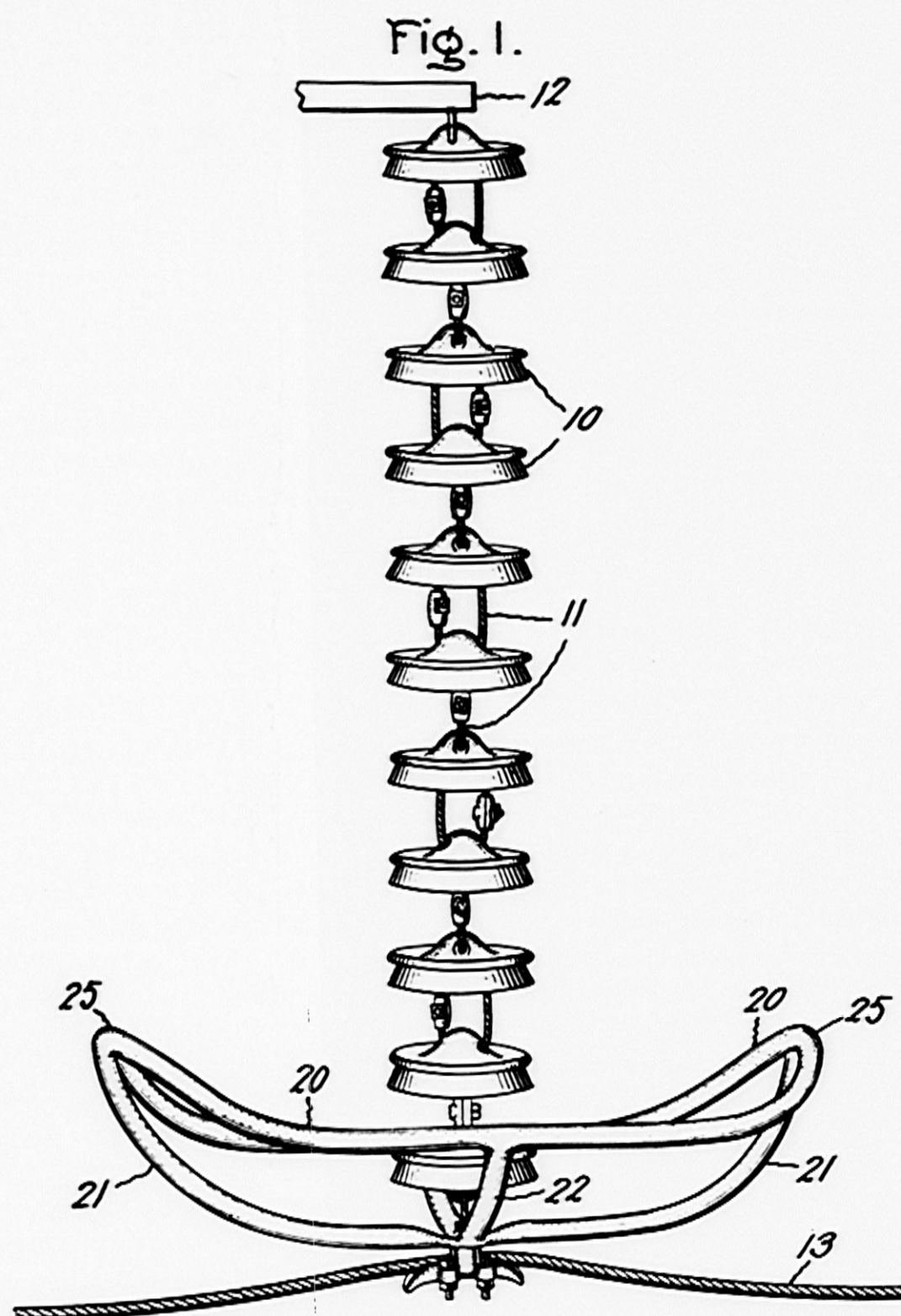
F. W. PEEK, JR

1,741,333

INSULATING SUPPORT

Filed Jan. 26, 1921

2 Sheets-Sheet 1



Inventor:
Frank W. Peek Jr.,
by *Albert G. Davis*
His Attorney

Patented Dec. 31, 1929

1,741,333

UNITED STATES PATENT OFFICE

FRANK W. PEEK, JR., OF PITTSFIELD, MASSACHUSETTS, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK

INSULATING SUPPORT

Application filed January 26, 1921. Serial No. 440,154.

My invention relates to insulating supports and especially to those composed of a plurality of interconnected insulating units arranged to support a line conductor.

5 The uneven distribution of voltage along a string of interconnected insulating units is well known, as described in my paper appearing on page 907 of the Transactions of the American Institute of Electrical Engineers for 1912. With a small number of units
10 this uneven distribution is not serious, and scarcely justifies the complication and expense required to overcome it. But with an increasing number of units, the distribution
15 becomes continually poorer. A limit is soon reached where additional units make no appreciable decrease in the potential duty of those units next the conductor. This limit for the ordinary strain type unit is in the
20 neighborhood of twelve units.

In general, the unit next to the conductor has the largest proportion of the total voltage across it, the succeeding units taking a smaller and smaller amount. This is unsatisfactory for two reasons; the units nearer the
25 conductor have to stand an excessive strain, and the units nearer the grounded end have a lower voltage across them than is desirable for economical service.

30 The object of my invention accordingly is to provide an improved arrangement of parts whereby substantially uniform voltage distribution along a string of interconnected units may be had.

35 In the prior art it had been sought to effect this object by the use of condenser elements disposed throughout the string of insulating units which would augment the capacitance at those points where it is desired to reduce the voltage gradients; the
40 voltage across a condenser unit varying inversely as its capacitance. This, however, is only an approximate solution of the voltage distribution problem since it does not eliminate the cause of the unequal distribution
45 which I have ascertained to be due to the form of the electric field about the insulating units produced by the leakage electrostatic flux emanating therefrom to ground.

50 In accomplishing the object of my inven-

tion therefore I provide an electrostatic flux controlling means for altering the form of the electric field in the neighborhood of the string of interconnected units in such wise that the leakage electrostatic flux is compensated for; whereby the gradients of the resulting field become substantially uniform
55 throughout the string.

For a more complete understanding of the nature and objects of my invention reference
60 should be had to the following detailed description taken in connection with the accompanying drawings in which:

Fig. 1 is a perspective view of a string of interconnected insulating units equipped
65 with my invention. Fig. 2 is a view mainly in vertical section of the arrangement shown in Fig. 1, parts being broken away; while Fig. 3 is a top plan view thereof. Fig. 4 is a top plan view of a modification. Figs. 5 to 10
70 inclusive are explanatory diagrams.

Referring now to the drawings, and to Figs. 1 to 3 in particular, 10 denotes the insulating units which may be made of porcelain or other suitable insulating material
75 and are of the so-called "strain" type as disclosed in United States Letters Patent No. 1,110,924 granted in the name of Hewlett, Sept. 15, 1914. These units 10 are interconnected by means of pieces of conducting cable
80 11 arranged to form the insulating string; the top end of which string is secured to a suitable support 12 while the lower end carries the conducting line or cable 13 which may be a high voltage feeder in an electrical
85 distributing system.

In order to alter the electric field about the cable 13 so that the voltage gradient across each unit 10 in the insulating string may be substantially the same, I employ the conduct-
90 ing member 20 conductively connected to the cable 13 by means of radial members 21, 22 etc. which extend from the cable 13.

The member 20 entirely encircles one or
95 more units 10, and has a contour in plan which is preferably oval or elliptical as shown in Fig. 3; the portions directly over the cable 13 being generally bent upwardly as shown at
25 so that it has a profile somewhat like a 100

crescent in shape, for a reason which will hereafter appear.

In Fig. 4 I have shown a modified form of conducting member for reforming the electrostatic field. The member here shown consists of an outer encircling part 30 and an inner encircling part 30' which are supported by radial members 31. The advantage in this form of conducting member using the plurality of encircling parts resides in the fact that the desired flux control is had without occupying much space laterally; since the respective diameters of parts 30 and 30' are greatly reduced as compared with those of member 20 when effecting the same flux control. This becomes an item of consideration where, in transmission systems, it is desired to reduce the clearances between line conductors to a minimum.

The exact configuration which the flux controlling member should have in any given instance may however substantially be determined from data obtained by plotting the original field and ascertaining the resulting fields had by inserting charges of given magnitude at various points; the oval member 20, or the member comprising parts 30, and 30' is conductively connected to the line conductor 13 and is therefore always charged at line potential. It is so disposed in the field about the insulating units 10 as to compensate for the leakage electrostatic flux from the various units in the insulating string so that the charges on the different units are substantially equal at any instant. Hence, the voltage gradient along the string is made approximately uniform. To state this in another way, the flux controlling member is so located that the capacitance between any insulating unit and the flux controlling member is equal to the capacitance between the same insulating unit and ground. The capacitance current from any unit to ground is therefore supplied by the capacitance current from the flux controlling member to the same unit. The voltage gradient along the string of insulating units is therefore determined solely by the series capacitances of the units and is therefore uniform.

This will become evident from the following consideration taken in connection with Figs. 5 to 10 where Fig. 5 shows an ordinary string of insulating units 40 without the flux controlling means of my invention the string being delineated in a fashion which makes evident their nature as a string of condensers in series. The metallic interconnecting members for the units are shown at 41, electrostatic flux lines R being shown as traversing the dielectric medium of the insulating units 40, the same extending from one metallic member to another except for the leakage flux lines R' which extend from members 41 directly to ground. It is thus seen that a part of the charging current flowing from the

line or cable 43 does not pass in succession to the next unit but flows directly to ground by way of the displacement current represented by the leakage flux R'.

It is thus seen that the charge at any instant is not the same on the several units but decreases successively with the consequence that the unit next the line has the greatest charge in the string and sustains a correspondingly greater portion of the voltage distribution.

This distribution is more readily perceived from a consideration of the arrangement shown in Fig. 6 where the string of insulators is represented as condensers 40' in series, having shunt capacitance to ground at 41' through which the displacement current flows. The curve shown at A in Fig. 7 is plotted to show the relative voltage distribution across each unit of this string. This curve has the well known logarithmic form and indicates that the voltage gradient (represented by its slope at each unit 40') is not uniform for the several units.

In Fig. 8 is depicted a string of insulating units similar to those in Fig. 5 but equipped with a flux controlling means 50 in accordance with my invention. This means is so proportioned and situated as indicated that it supplies directly the leakage flux that normally strays to ground and charges by induction each unit to the amount that it otherwise has lost. This is equivalent to supplying the displacement currents to ground through a set of shunt condensers connected directly to the line as depicted at 50' in Fig. 9. Hence the charging current flowing in succession through the condensers 40' in series is everywhere equal, none now straying to ground; therefore the charges on the several units are equal so that the voltage distribution among them becomes uniform as indicated by the straight line curve shown at B in Fig. 10.

The flux controlling member, in addition to reforming the field about the string of insulating units so as to get a substantially uniform voltage distribution, is preferably designed so as to draw arcs away from the string should any occur. For this reason it is desirable to have the member 20 or parts 30 disposed out from but well up along the string. It is for this reason that the member 20 has the bent up portions shown at 25. These portions are disposed over the conductor 13, as it is desired to reduce the span across the parts of member 20 transverse to the conductor in order that the clearance distance between lines may not need to be large.

It will of course be understood that where the problem of voltage distribution has been solved, the problem of preventing corona has also generally been solved, since corona arises from the fact that the air adjacent some elec-

trified body has been overstressed. Consequently, it is only necessary to redistribute the strain so that at no point is the air overstressed in order to prevent corona. By accomplishing substantially uniform voltage distribution throughout the string of insulating units, I accordingly avoid overstraining the air in contact with any of the units in the string, thus avoiding corona, which is a still further function of the flux controlling member when constructed according to my invention.

Having now described an embodiment of my invention which is at present the best means known to me for carrying the same into effect, I would have it understood that this is merely illustrative and that I do not mean to be limited thereby to the precise details shown, nor restricted in the choice of recognized equivalents except as defined in my claims hereunto annexed.

What I claim as new and desire to secure by Letters Patent of the United States, is:—

1. A string of more than two interconnected insulating units adapted to support an electrical conductor, said string being provided with electrostatic flux controlling means conductively connected to the conductor and proportioned and situated about the insulating units so as substantially to compensate directly for the leakage electrostatic flux of the string, whereby uniform voltage distribution results.

2. A string of interconnected insulating units adapted to support an electrical line conductor, said string being provided with electrostatic flux controlling means comprising a member disposed about the line end of said string, conductively connected to the conductor, and located and proportioned to provide capacitance in shunt to said unit substantially sufficient to neutralize the effect of the capacitance to ground of the respective units.

3. The combination with a line conductor, of a string of more than two interconnected insulating units arranged to support the same, and an electrostatic flux controlling means comprising a conducting member conductively connected to the line, said member being elongated in form and positioned in the electric field about the line end of said string so as substantially to supply and directly compensate for the leakage electrostatic flux from each of the component units to ground, whereby uniform voltage distribution results.

4. The combination with a line conductor, of a string of interconnected insulating units arranged to support the same, and an electrostatic flux controlling means comprising a conducting member conductively connected to the line, said member being generally oval in form and proportioned and situated in the electric field about the line end of said string to provide capacitance in shunt to the compo-

nent insulating units individually substantially sufficient to neutralize the effect of their respective capacitances to ground.

5. The combination with a line conductor, of a plurality of insulating units joined in a string by metallic connections and supporting said conductor, and a conducting member conductively connected to said line conductor and proportioned and located in the electric field adjacent the line end of said string to supply directly to each unit a capacitance current substantially equal to the capacitance current from the unit to ground.

6. The combination with a line conductor, of a plurality of insulating units joined in a string by metallic connections, and an oval conducting member having radial supports conductively connecting it to the line conductor and proportioned and located in the electric field adjacent the line end of said string to supply directly to each unit a capacitance current substantially equal to the capacitance current from the unit to ground.

7. The combination with a line conductor, of a plurality of strain type insulating units joined in a string by metallic connections and supporting said line conductor, a conducting member having an oval shaped periphery and a crescent shaped profile disposed about said units at the line end, the cusps of the crescent being over the line, and conducting radial supports for said member extending therefrom to the line where supported by said units.

8. In combination with a conductor to be insulated, an insulator string comprising a plurality of insulating units connected with said conductor, and means for distributing the electrostatic stresses to the units of the insulator and relieving an insulating unit which is normally subjected to an undue proportion of the electrostatic stress, said means comprising a second conductor specially disposed about the portion of the insulator string adjacent to the first-named conductor and conductively connected with the first-named conductor.

9. The method of protecting string insulators of high tension conductors which consists in distributing the electrostatic stresses to the units of the string and relieving an insulator unit of the string which is normally subjected to an undue proportion of the electrostatic stresses, by disposing in spaced relation about the end of the string adjacent the high tension conductor a second conductor conductively connected with the high tension conductor.

In witness whereof, I have hereunto set my hand this 24th day of Jan., 1921.

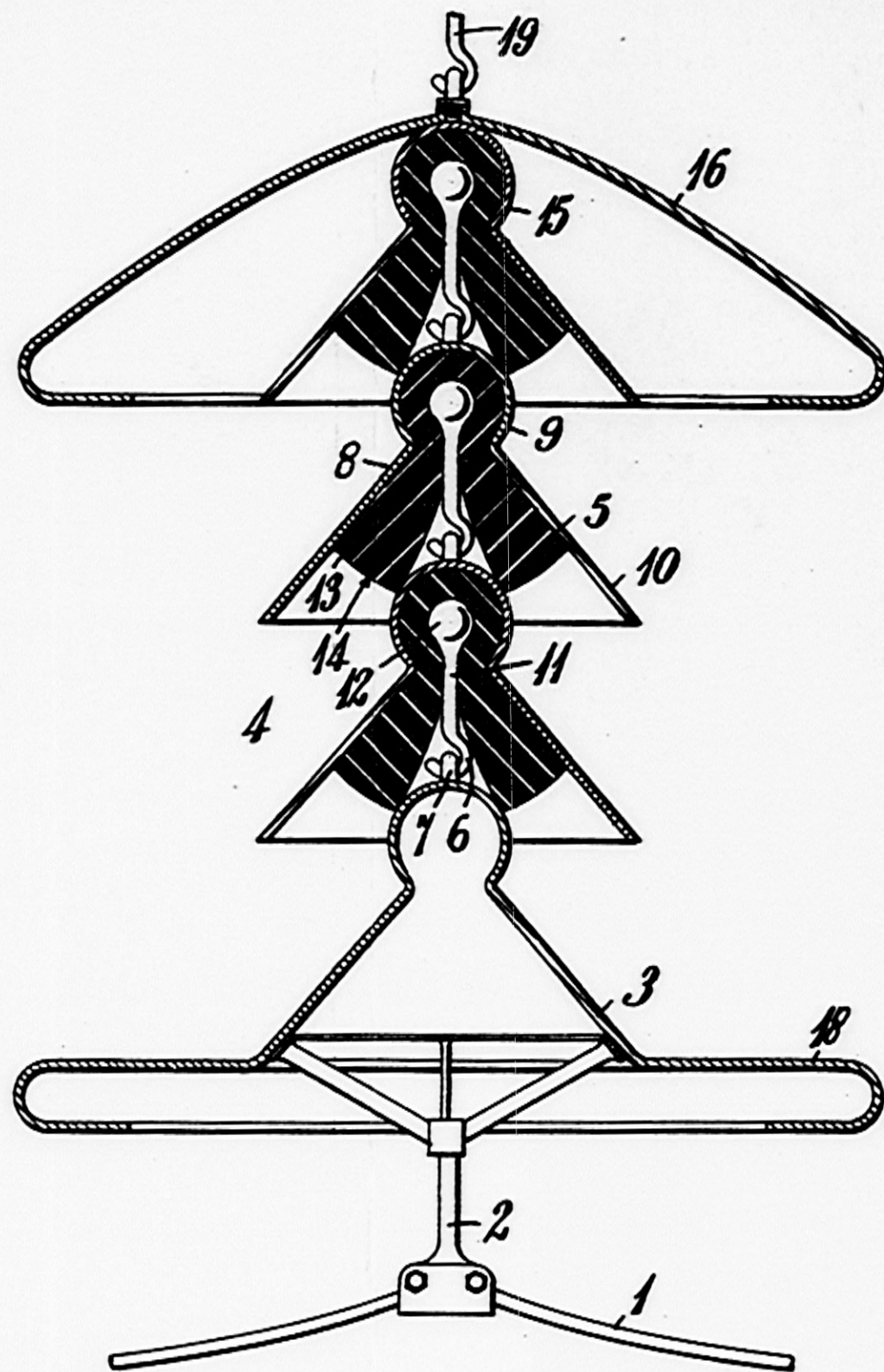
FRANK W. PEEK, JR.

C. LE G. FORTESCUE.
SUSPENSION INSULATOR.

APPLICATION FILED MAY 25, 1914. RENEWED DEC. 31, 1917.

1,259,385.

Patented Mar. 12, 1918.



WITNESSES:

Fred. H. Miller
Geo. W. Hansen.

INVENTOR

Charles Le G. Fortescue
BY
Wm. H. Carr
ATTORNEY

UNITED STATES PATENT OFFICE.

CHARLES LE G. FORTESCUE, OF PITTSBURGH, PENNSYLVANIA, ASSIGNOR TO WESTINGHOUSE ELECTRIC AND MANUFACTURING COMPANY, A CORPORATION OF PENNSYLVANIA.

SUSPENSION-INSULATOR.

1,259,385.

Specification of Letters Patent.

Patented Mar. 12, 1918.

Application filed May 25, 1914, Serial No. 840,702. Renewed December 31, 1917. Serial No. 209,795.

To all whom it may concern:

Be it known that I, CHARLES LE G. FORTESCUE, a subject of the King of Great Britain, and a resident of Pittsburgh, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Suspension-Insulators, of which the following is a specification.

My invention relates to insulators, and particularly to suspension-type insulators for supporting high-potential lines or conductors.

When a difference of potential exists between adjacent conducting bodies, the air or other interposed insulating medium is subjected to stresses by reason of the electric field produced. A field of this character may be represented by means of the lines called "electrostatic flow lines," the distribution and arrangement of which are dependent upon the shapes and sizes of the conducting bodies, their spacing, the character and shape of the insulating medium and the potential of the bodies.

Heretofore, suspension-type insulators, such as porcelain insulators, flexibly connected to one another and having corrugated surfaces or otherwise so constructed as to provide very long surface distances, have been interposed between conducting bodies in order to insulate them from each other. It was intended that these insulating bodies, by providing long leakage paths between the conducting bodies, would substantially preclude the occurrence of surface discharges. It is well known that discharges of this kind occur when the air adjacent to the insulating bodies is subjected to undue concentrations of potential stresses which may result from the incorrect shapes of conducting terminals, or from the incorrect form of insulating bodies, or from both of said factors.

As disclosed in Patent No. 1,129,520, granted February 23, 1915, to the Westinghouse Electric and Manufacturing Company upon an application filed by K. C. Randall, S. W. Farnsworth and C. Le G. Fortescue, the concentration of potential stresses caused by the incorrect form of insulating bodies may be entirely avoided by making them of such shapes as to conform to the electrostatic lines of force which would represent the existing electric fields between the conducting bodies if they were

located in a homogeneous insulating medium, such as air.

The concentration of potential stresses caused by the incorrect shape of the conducting terminals may be substantially precluded by modifying the form of their adjacent and opposed surfaces, and the insulating strength of a transmission line support may be increased if the external electrostatic field surrounding the support is so distributed as to insure the distribution of uniform surface stresses thereupon, as disclosed in my patent application, Serial No. 837,742, filed May 11, 1914.

One object of my invention is to provide a suspension-type insulator for high-voltage conductors which is adapted to utilize, to substantially its full insulating value, the air or other insulating medium in which conductors are disposed.

Another object of my invention is to provide a suspension-type insulator that, for a given voltage, will be of smaller dimensions than has heretofore been utilized for a similar voltage, or that, for a given size, may be capable of withstanding higher voltages than suspension insulators not built in accordance with my invention.

My invention is illustrated in the accompanying drawing in which the single figure is a sectional view of a suspension-type insulator embodying a form of my invention.

Referring to the drawing, a high-potential conductor 1 is secured, by means of a clamp 2, to a conducting member 3 which constitutes the lower member of my suspension-type insulator 4. The insulator 4 comprises a plurality of superposed elements or condensers 5 which are flexibly connected to one another by any suitable means. In the device shown, the flexible connection between the elements 5 comprises a hook 6 and an apertured lug 7 that is located on the top portion of the element 5. Each element 5 comprises a conducting member or electrode 8 the hollow top portion 9 of which has a contracted lower end and the bottom portion 10 of which is of frusto-conical shape. A rod 11, having an enlarged end 12, projects into the electrodes 8 and is so disposed that its enlarged end 12 is surrounded by the top portion 9. Insulating material 13 is interposed between the said rods and the electrodes 8 and serves to insulate the rod from the electrode and also to hold the rod

firmly in position. The exposed surface 14 of the insulating body is of such shape as to substantially conform to the lines of force of the electric fields existing between the adjacent electrodes or conducting members 8. As above explained, this configuration of the exposed surface of the insulating body 13 permits the air to be utilized to its full insulating value and, therefore, greatly increases the break-down potential between the electrodes 8.

My invention comprises a system of condensers connected in series relation to enhance the insulating properties of which, it is highly desirable to obtain uniform divisions of potential difference between the elements 5. In order to increase the insulation strength of my insulator, the external electrostatic field surrounding the same should be so distributed as to insure a substantially uniform surface distribution of the electrostatic stresses imposed thereupon. For this purpose, I have provided an upper conducting member 15 having a conducting extension 16 of discoidal shape and a lower conducting member 13 having a conducting extension 18 of discoidal shape.

It is desirable, for maximum efficiency, and in order that my improved insulator may be of minimum length, that the external electrostatic field be substantially uniform and agree with the division of potential between the individual elements 5 comprised in the structure 4. The electrodes 16 and 18 are provided to approximate the result which would be obtained by bounding the insulating support 4 by infinite parallel conducting planes perpendicular to the axis of the insulator. As above mentioned, this will effect a substantially uniform distribution of the electrostatic field external to, and surrounding, the insulator 4. The condition for uniform distribution of potential among the elements 5 is that the fluxes leaving the electrodes 8 shall be of like value; this means that the capacitance of each electrode 8 to ground must be inversely as its potential, and that the capacitance between adjacent pairs of electrodes must be uniform. This is approximated very closely if the parallel plane surfaces or the flux distributing surfaces of the upper or low-potential electrode 15 and the lower or high-potential electrode 3 coincide with, or lie in the planes of, the lower edges of the electrodes 16 and 18, respectively. An insulator made according to the above plan conforms to the law of uniform fields, and is insured against concentrations of electrostatic stresses upon its surfaces. Again, if the dimensions of the insulating structure are doubled, the ability of the insulator to resist high potentials is doubled.

It is unnecessary, in order to obtain good results, however, to so design the suspension

insulator as to effect exactly uniform division of the potential difference between the various elements comprising the support. If each of the elements 5 assumes its proper share of the potential difference between the conductor 1 and the supporting structure or tower (not shown), and a substantially uniform distribution of the electrostatic field surrounding the insulator 4 is obtained, the insulator has a very high insulating value. Of course, with this approximation, the maximum efficiency is not obtained.

In the structure shown, the lower extension 18 is charged to the potential of the conductor 1 by being electrically connected thereto by means of the metallic clamp 2. The upper extension 16 assumes a low potential by reason of its being connected, by means of a hook 19, to the supporting structure or tower (not shown). The conically flared lower portions 10 of the electrodes 8 extend beyond the insulating bodies 13 and thereby shield them from rain, dust, etc. As in all suspension type insulators, it is desirable to have flexible connecting means between the various insulating elements, and I have shown such flexible connecting means. It will be understood that various mechanisms and devices may be utilized for flexibly connecting the elements 5 to one another, and I do not claim the specific form of flexible connecting means shown and described.

Although I have shown and described devices of specific structural details, many modifications may be effected therein within the spirit and scope of my invention, and I desire that only such limitations shall be imposed as are indicated in the appended claims.

I claim as my invention:

1. In an insulating structure, a plurality of superposed conducting members comprising hollow top portions having contracted lower ends and bottom portions extending laterally from said ends, rods having enlarged ends respectively surrounded by the said top portions and having their lower ends attached to the top portions of the adjacent conducting members, and bodies of insulating material interposed between said members and said rods and having recesses to receive the top portions of the adjacent conducting members, the exposed portions of said insulating bodies being shaped to substantially conform to the lines of force of the electric fields existing between the adjacent conducting parts.

2. In an insulating structure, a plurality of superposed conducting members comprising hollow top portions having contracted lower ends and bottom portions extending laterally from said ends, rods having enlarged ends respectively surrounded by the said top portions and having their lower

ends flexibly secured to the top portions of the next succeeding conducting members, and bodies of insulating material interposed between said members and said rods, the exposed portions of said insulating bodies being shaped to substantially conform to the lines of force of the electric field existing between the adjacent conducting parts, the conducting members extending laterally beyond the insulating bodies.

3. In an insulating structure, a plurality of superposed conducting members comprising hollow top portions having contracted lower ends and bottom portions extending laterally from said ends, extensions for the top and bottom conducting members that extend laterally beyond the intermediate conducting members, rods having enlarged ends respectively surrounded by the top portions of the said members and having their lower ends flexibly secured to the top portions of the next succeeding conducting members, and bodies of insulating material interposed between said members and said rods, the exposed portions of said insulating bodies being shaped to substantially conform to the lines of force of the electric field existing between the adjacent conducting parts.

4. In an insulating structure, a plurality of superposed conducting members comprising hollow top portions having contracted lower ends and bottom portions extending laterally from said ends, extensions for the top and bottom conducting members that extend laterally beyond the intermediate conducting members, rods having enlarged ends respectively surrounded by the top portions of the said members and having their lower ends attached to the top portions of the next succeeding conducting members, and bodies of insulating material interposed between said members and said rods, the exposed portions of said insulating bodies being shaped to substantially conform to the lines of force of the electric field existing between adjacent conducting parts, the conducting members extending laterally beyond the insulating bodies.

5. In an insulating structure, a plurality of superposed conducting members comprising hollow top portions having contracted lower ends and bottom portions extending laterally from said ends, apertured lugs provided on the top portions, rods having enlarged ends respectively surrounded by said top portions, and hooks at their other ends respectively engaging the said lugs, and bodies of insulating material interposed between said members and said rods, the ex-

posed portions of said insulating bodies being shaped to substantially conform to the lines of force.

6. In an insulating structure, a plurality of superposed elements each comprising a conducting member having a conically flared bottom portion, a rod projecting thereinto, and bodies of insulating material interposed between said conducting members and said rods, and flexible connecting means between the said elements, the top and bottom conducting members having extensions that project laterally beyond the intermediate conducting members in order to effect a substantially uniform surface distribution of the electrostatic field surrounding the said elements.

7. In an insulating structure, a plurality of superposed elements each comprising a conducting member having a conically flared lower portion, a rod projecting thereinto, and insulating bodies interposed between said conducting members and said rods, and flexible connecting means between the said elements, discoidal shaped extensions of conducting material for the upper and lower conducting members so disposed that their parallel surfaces coincide with the planes of the edges of said upper and lower conducting members in order to obtain a substantially uniform distribution of potential difference between the conducting members.

8. In an insulating structure, a plurality of superposed elements each comprising a conducting member having a conically flared lower portion, a rod projecting thereinto, and insulating bodies interposed between said conducting members and said rods, the exposed surfaces of the insulating bodies being shaped to substantially conform to the lines of force of the electric field existing between adjacent conducting members, and flexible connecting means between the said elements, the upper and the lower conducting members having portions of discoidal shape that extend in planes that are coincident with the planes of the edges of said upper and said lower conducting members in order to obtain a substantially uniform division of potential difference between the conducting members.

In testimony whereof, I have hereunto subscribed my name this 21st day of May, 1914.

CHARLES LE G. FORTESCUE.

Witnesses:

GOLDIE E. MCGEE,
B. B. HINES.

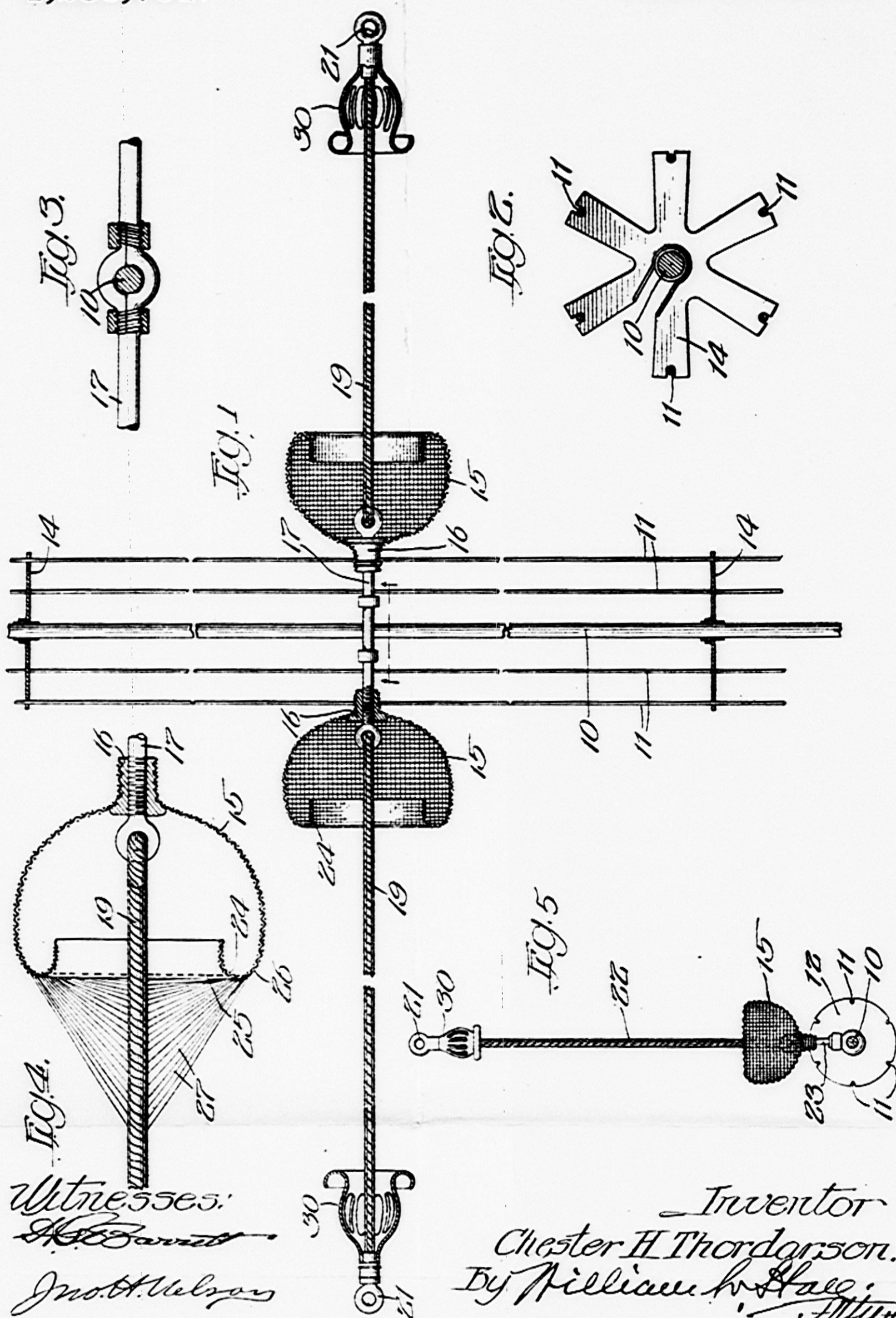
C. H. THORDARSON.

LONG DISTANCE HIGH POTENTIAL ELECTRIC POWER SYSTEM.

APPLICATION FILED OCT. 18, 1915.

1,288,751.

Patented Dec. 24, 1918.



UNITED STATES PATENT OFFICE.

CHESTER H. THORDARSON, OF CHICAGO, ILLINOIS.

LONG-DISTANCE HIGH-POTENTIAL ELECTRIC-POWER SYSTEM.

1,288,751.

Specification of Letters Patent.

Patented Dec. 24, 1918.

Application filed October 18, 1915. Serial No. 56,453.

To all whom it may concern:

Be it known that I, CHESTER H. THORDARSON, a citizen of the United States, and a resident of Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Long-Distance High-Potential Electric-Power Systems; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, and to the characters of reference marked thereon, which form a part of this specification.

This invention relates to improvements in long distance high potential electric power transmission systems, and refers to a novel surge damping transmission line, and to insulating devices for supporting said line.

Among the objects of my invention is to provide a novel long distance transmission line for high tension electric current which is so constructed and arranged as to automatically balance thereon abnormal pressures, due to surges or other conditions which tend to burn out insulators, transformers and other translating devices on the line, and thereby render the system stable and dependable.

Other objects of the invention are to improve and simplify and to reduce the cost of long distance high potential electric power transmission systems, and the invention consists in the combination and arrangement of the parts shown in the drawings and described in the specification and is pointed out in the appended claims.

In the drawings:—

Figure 1 is a detail of a high tension line embodying my invention.

Fig. 2 is a cross section on the line 2—2 of Fig. 1.

Fig. 3 is a detail of the means for connecting the line to the rope insulators.

Fig. 4 is a diagrammatic view, illustrating the action of the protecting electrostatic shield shown in Fig. 1.

Fig. 5 illustrates the electrostatic shield applied to another form of insulating suspension device for high potential transmission lines.

In accordance with my invention, the transmission line comprises a main or central conductor 10 and a series of surrounding, annularly disposed smaller conductors 11 which are spaced from the central con-

ductor 10 by a series of disks 12 spaced along the line, as shown in Fig. 5, or a series of spiders 14 as shown in Fig. 2. The function of the disks 12 or spiders 14 is that of separators to space the outer conductors from the central conductor. The wires 11 are considerably smaller than the main conductor and of metal of higher resistance. The said separators, 12, 14, are preferably of non-magnetic material and are mounted in any suitable manner upon the central conductor 10. The diameter of said separators is dependent upon the current pressure on the line, and they are spaced at such distance apart, depending upon their diameters, as to avoid any possible sagging of the outer conductors bringing them into contact with the main or central conductor 10. The said separators have good electrical contact with both the central conductor 10 and the outer concentric series of conductors 11 so as to make dependable contact between the outer and the inner conductors.

The purpose of arranging the conductors 11 parallel to and spaced from the central conductor is to steady the current flow on the line and to damp surges by transforming the energy of a surge into heat in the parallel conductors 11 so that the energy of the surge is not thrown upon insulators, transformers or like electrical devices connected in the high tension systems. A surge or wave having a steep front will travel along the outer conductors and expend a portion of its energy into heat, due to the much higher resistance of said outer or parallel conductors.

Any change in the magnetic field around the central conductor 10 which is not accompanied by a corresponding and proportionate change of potential on the line produces by induction a current flow in the outer or parallel conductors in a direction opposite to the flow in the main conductor, which induced current flows inwardly along the separators 12 and returns to the main or central conductor, thereby forming a closed circuit. These induced currents in the surge damping outer parallel conductors have the effect of maintaining a better phase relation between the current and potential wave.

The distance apart of the separators 12 will depend upon the line conditions and the potential of the current. Said separators, being in electrical contact as they are

with the inner and outer conductors, divide the transmission line into a plurality of sections, each of which is, in a sense, self controlling with respect to current flow variations. That is to say, each section thus formed, and including closed circuits through the outer conductors and separators, has its part in dissipating the energy of a surge, so as to prevent an accumulation of energy on the line due to inertia of current flow, such as would be dangerous to insulators and electrical devices in the transmission system. The line becomes, therefore, self balancing.

By the use of my improved transmission line, it becomes possible to transmit and control higher potential energy than has heretofore been practicable by known transmission systems. Furthermore my improvements greatly lessen the danger of burning out electrical devices and insulators in the system when operating at what is considered practical potentials in the present systems.

I have found that when operating at very high potentials, as for instance from two hundred thousand volts and upward, a most satisfactory form of insulator is like that shown in my pending application for U. S. Letters Patent, Serial No. 691,801, wherein the insulating support consists of a rope saturated with tar or other waterproofing or insulating material, or otherwise constructed to produce a water-proof insulating device. In the higher potentials, however, it become necessary, in order to avoid burning the rope at its point of anchorage with the line, to provide a special construction, in the nature of a protector or shield at the part of the rope where it is secured to the high tension line. Said shield is indicated at 15 in Figs. 1, 4 and 5. It preferably has the form of a wire basket-like structure which is open at its side remote from the line. At its other closed side it is provided with a metallic bushing or ferrule 16 which is fitted closely in metal to metal contact over an anchor bar 17 which directly engages the central conductor of the transmission line, being fastened to said conductor in any suitable manner. Said bushing may be screw threaded to the anchor bar. The anchor bar extends into the basket and is provided therein with an eye to receive the rope 19 which constitutes the insulating and suspension element. As shown in Figs. 1, and 2 the rope insulators 19 are disposed horizontally at each side of the line and are adapted to be attached at their outer ends by fittings 21 to poles or other supports. As shown in Fig. 5 the insulating and suspension rope 22 is disposed vertically from an overhead support to sustain the transmission line.

The anchor fitting 23 shown in Fig. 5 is attached to the basket in the same general

manner as the anchor bar 17, said fitting extending into the basket and provided therein with an eye to which the rope is attached.

The edge 24 of the basket 15 around the opening therein, and through which the rope extends, is curved inwardly, thereby making the radius of the opening shorter than the length of the rope from its attachment to the anchor bar to a point in the plane of the outer edge of the basket, indicated by the dotted line 25 in Fig. 4. As herein shown the edge of the basket is turned some distance backwardly thereinto from its mouth to produce a rather broad flange-like terminal. However, this particular configuration need not necessarily be followed, the point being to constrict the opening or mouth of the basket. The basket is rounded at the portion thereof which is turned inwardly as indicated at 26 to avoid abrupt corners and to prevent sharp brush discharges.

Within the plane of the outer edge of the basket there is a neutral or balanced electrostatic field, as indicated in Fig. 4, which figure is a true representation of the glow or brush discharge as visible under electrostatic stress when the surface of the rope has been thoroughly moistened with rain water. This brush discharge quickly blows off all surface moisture and maintains the rope as a good insulator. The air space between the rope and the inturned flange 24 of the basket acts, in connection with the curved surface 26, as an electrostatic cushion to maintain a uniform and outwardly graded electrostatic stress on the surface of the rope as indicated by the lines 27 in Fig. 4. Thereby the brush discharge or creepage is prevented from burning into the ends of the rope, as would occur under high potentials if the protector 15 were not present.

The anchor fittings 21 by which the ropes are attached to the line supports may be provided with bell shaped perforated shields 30 which extend inwardly for a distance over the rope and act to protect the rope at its outer anchorage in the same general manner as the basket-like protector 15.

It will be understood that the structural details of the illustrated embodiment of my invention are capable of variation within the spirit and scope of the claims hereto appended and that it is the intent to claim all of inherent novelty shown in the drawings and described in the specification.

The basket-like shields shown are not herein claimed, but are claimed in a divisional application filed by me on the 23rd day of April, 1917, Serial No. 163,867.

I claim as my invention:—

1. In long distance electric power transmission systems, a main transmission line, and auxiliary lines radially spaced from and electrically connected to the main line

at points throughout its length to divide the main line into surge damping sections.

2. A long distance electric transmission line, comprising a central conductor and 5 surrounding parallel, relatively high resistance conductors connected in multiple with the central conductor for current flowing in normal direction and connected to said central conductor to form relatively short 10 closed circuits therewith for current induced in the high resistance wires by the magnetic field of the central conductor.

3. A transmission line for electric power transmission systems comprising a main 15 conductor and an outer, radially spaced parallel conductor of relatively high resistance and current conducting spacers between the conductors at intervals along the line.

4. A transmission line for electric power 20 transmission systems comprising a central conductor, a series of parallel, relatively high resistance conductors surrounding the central conductor and current conducting spacers between and in contact with the 25 central and outer conductors at intervals along the line.

5. A transmission line for electric power transmission systems comprising a central

conductor, a series of parallel, relatively high resistance conductors surrounding the 30 central conductor and non-magnetic metallic spacers arranged at intervals along the line between the central and surrounding conductors and constituting electrical connections therebetween. 35

6. The method of balancing high tension currents on long distance transmission lines which consists in establishing at intervals 40 along the line closed circuits through outer parallel conductors that lie in the magnetic field of the line.

7. The method of balancing high tension currents on long distance transmission lines which consists in arranging about the line 45 a series of parallel conductors and electrically connecting said conductors to the line at intervals therealong.

In testimony that I claim the foregoing as my invention I affix my signature, in the presence of two witnesses, this 15th day of 50 October, A. D. 1915.

CHESTER H. THORDARSON.

Witnesses:

W. L. HALL,

RUTH E. ZETTERVALL.

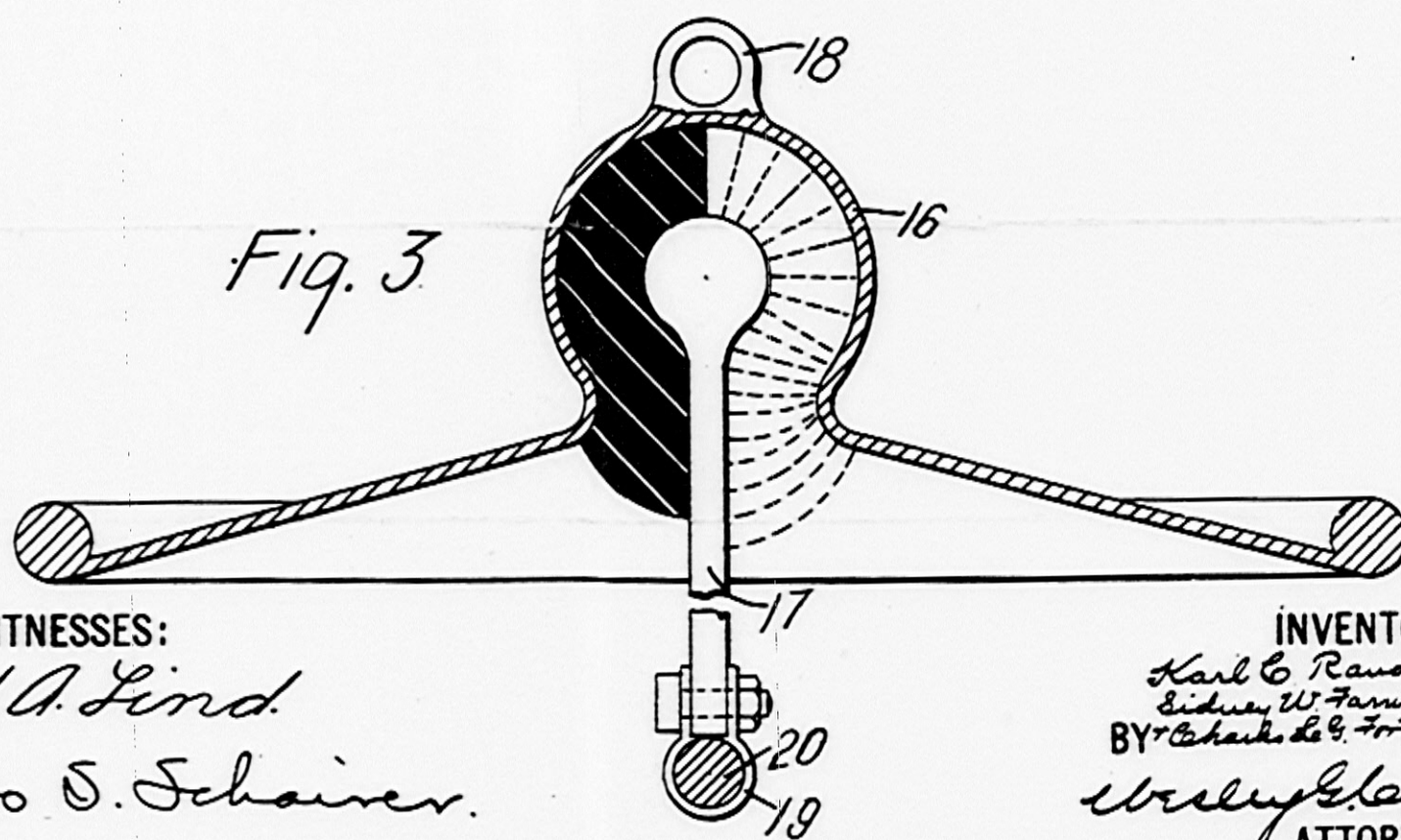
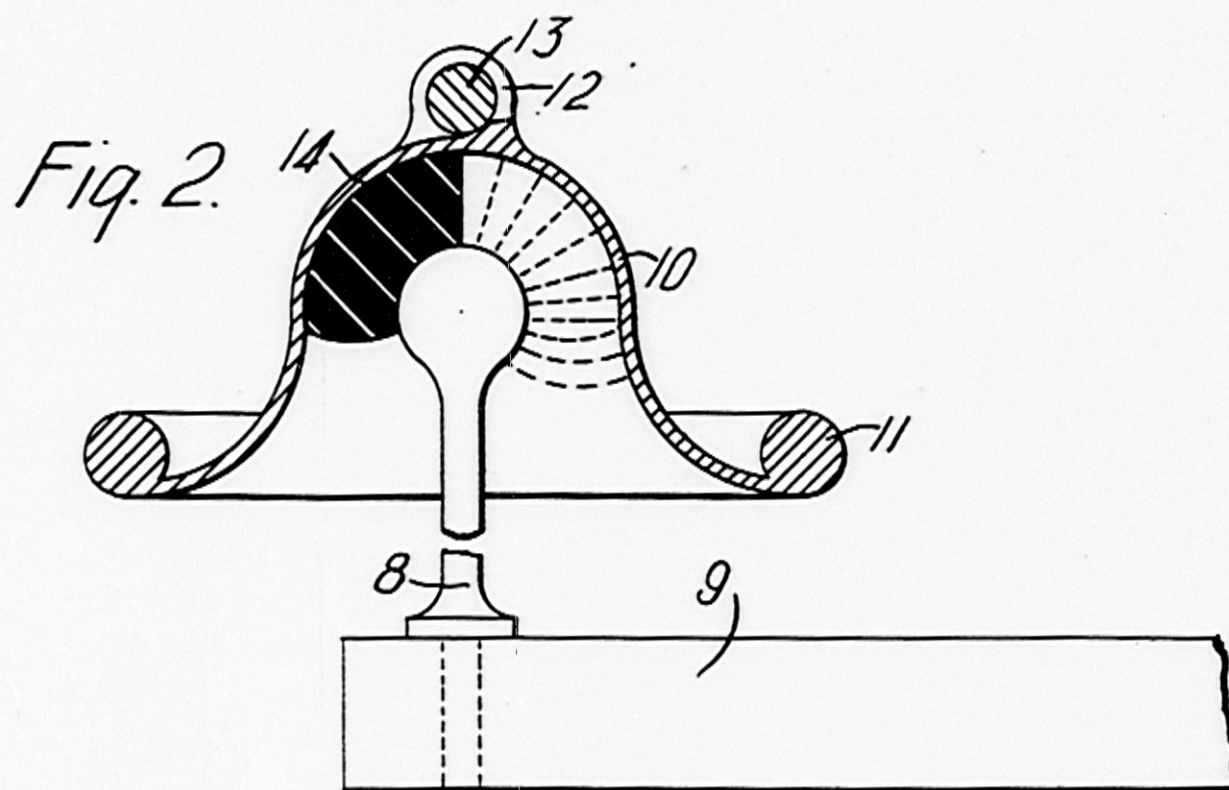
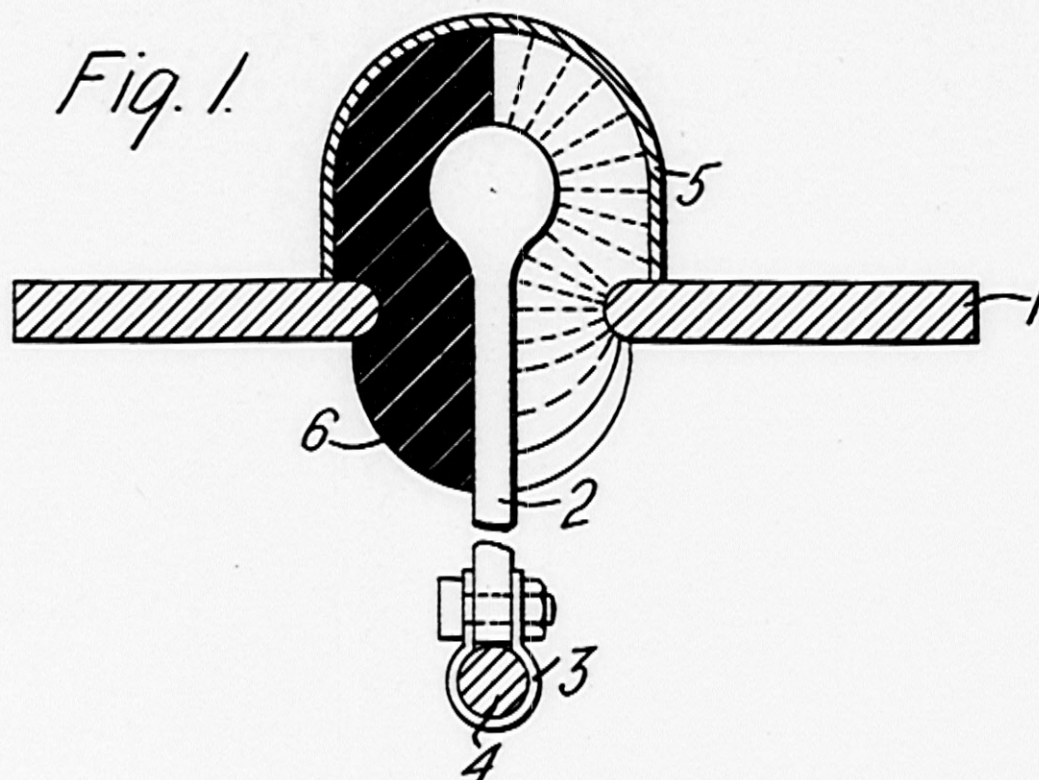
Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."

K. C. RANDALL, S. W. FARNSWORTH & C. LE G. FORTESCUE.
ELECTRICAL INSULATOR.

APPLICATION FILED DEC 31, 1913. RENEWED JAN. 14, 1915.

1,129,521.

Patented Feb. 23, 1915.



WITNESSES:
Fred. A. Lind.
Otto S. Schainer.

INVENTORS
Karl C. Randall
Sidney W. Farnsworth
BY *Charles L. G. Fortescue*
Wesley E. Carr
ATTORNEY

UNITED STATES PATENT OFFICE.

KARL C. RANDALL, OF EDGEWOOD PARK, AND SIDNEY W. FARNSWORTH AND CHARLES LE G. FORTESCUE, OF PITTSBURGH, PENNSYLVANIA, ASSIGNORS TO WESTINGHOUSE ELECTRIC AND MANUFACTURING COMPANY, A CORPORATION OF PENNSYLVANIA.

ELECTRICAL INSULATOR.

1,129,521.

Specification of Letters Patent.

Patented Feb. 23, 1915.

Original application filed April 30, 1910, Serial No. 558,744. Divided and this application filed December 31, 1913, Serial No. 809,746. Renewed January 14, 1915. Serial No. 2,277.

To all whom it may concern:

Be it known that we, KARL C. RANDALL and SIDNEY W. FARNSWORTH, citizens of the United States, and CHARLES LE G. FORTESCUE, a subject of the King of Great Britain, residents, respectively, of Edgewood Park, of Pittsburgh, and of Pittsburgh, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Electrical Insulators, of which the following is a specification, this application being a division of application Serial No. 558,744.

Our invention relates to electrical insulating bodies or structures and particularly to such as are employed for supporting high-voltage lines or conductors.

The object of our invention is to provide an insulating support for electrical conductors that shall be simple in structure and that, for a given voltage, may be of minimum practical dimensions, and of maximum economy of construction, or that, for a given size, may be capable of withstanding higher voltages than insulators of other forms or constructions.

In another application, Serial No. 558,744, filed April 30, 1910, we have disclosed the general principles of our invention and have broadly claimed insulating structures to which said principles have been applied. The present application discloses and covers certain specific structures disclosed in the original application.

Our invention is illustrated in the accompanying drawing, Figure 1 of which is a view in section and in side elevation of a supporting structure for a high-voltage conductor that is constructed in accordance therewith, and Figs. 2 and 3 are similar views of modified forms of the device shown in Fig. 1. One-half of the insulating body is shown in each of the figures in cross-section, and the electric field existing in the insulating body is represented in the other half by broken lines.

In the device of Fig. 1, a conducting plate 1, or other suitable supporting structure, is provided with an aperture through which a rod 2 projects, the upper end of the rod being enlarged, and being preferably in the form of a sphere. The lower end of the

rod 2 is provided with a clamp 3 whereby a conductor or line wire 4 is secured to and supported by the said rod. The upper end of the rod is surrounded by a cap or shield 5, the main portion of which is preferably substantially spherical and the inner face of which is substantially parallel to the enlarged upper end of the rod 2. The cap or shield 5 is preferably secured to the supporting plate 1. The space within the cap or shield 5, between it and the rod 2, is filled with a suitable insulating compound or body 6 that is extended so as to surround a part of the rod 2 below the supporting plate 1, the exposed portions of the said body being shaped to substantially conform to the direction of the lines of force of the static field existing between the rod 2 and the surrounding conducting parts. The cap or shield 5 protects the insulating body from the weather and also mechanically guards it, and it is so shaped as to influence the electric field in the insulating body. In the preferred form of the device, the shield is so shaped relatively to the enlarged end of the rod 2 as to cause the lines of force of the said field, or the greater portion thereof, to be straight, whereas the lines of force representing the field between the diverging portions of the rod and the surrounding parts is curved, all substantially as represented in the right-hand portion of Fig. 1.

Fig. 2 represents a pin type insulator in which the rod 8, having an enlarged upper end, constitutes the supporting pin and is carried by a cross arm 9, or any other suitable support. The upper end of the rod 8 is surrounded by a cap or shield 10, the upper portion of which is substantially parallel to the upper enlarged end of the rod 8, and the lower portion of which is substantially bell-shaped and diverges laterally from the rod 8. The lower edge of the cap shield 10 is provided with a rounded rim 11, which avoids concentration of stress upon this portion of the shield. The shield 10 is provided, upon its top, with an apertured lug or a suitable clamp 12 for engaging and supporting a conductor 13. A body of suitable insulating material 14 is interposed between the upper enlarged end of the rod 8 and the adjacent substantially

parallel portion of the shield 10, the exposed portion of the insulating body being shaped to substantially conform to the direction of the lines of force constituting the static field existing between the rod 8 and the shield 10.

The device illustrated in Fig. 3 is a suspension type of insulator which comprises a shield 16 similar to the shield 10 of Fig. 2, but somewhat different in form. The substantially spherical top portion of the shield 16 is extended to surround a greater portion of the enlarged upper end of the rod 17 than in the device of Fig. 2, in order that, when the space between the said parts is filled with suitable insulating material, the rod cannot be pulled out of the shield unless the force exerted is very great and in excess of the tension to which the said parts will normally be subjected while in service. The shield 16 is provided with a lug 18 whereby the device may be suspended from any suitable support, and the rod 17 is provided, at its lower end, with a clip or clamp 19 similar to that employed in the device of Fig. 1 for securing a conductor 20 to the lower end of the rod.

We claim as our invention:

1. An insulating support comprising a rod of conducting material having one end enlarged into a sphere, a substantially bell shaped conducting member inclosing the enlarged end of the conducting rod, and an interposed insulating body for maintaining the relative positions of the two conducting members and having its exposed surfaces so shaped as to conform to the electric field existing between the members.

2. An insulating structure comprising a conducting rod having an enlarged end, a conducting member surrounding the rod and having a portion that is substantially parallel to the enlarged end of the rod and another portion that extends laterally from the rod, and a body of insulating material interposed between the rod and said member the exposed portions of which are shaped to substantially conform to the direction of the static lines of force extending between the said conducting parts.

3. An insulating structure comprising a conducting rod having an enlarged end, a conducting member surrounding the rod and having a portion that is substantially parallel to the enlarged end of the rod and another portion that extends laterally from the rod and is provided with a rounded rim, and a body of insulating material interposed between the rod and said member the exposed portions of which are shaped to substantially conform to the direction of the static lines of force extending between the said conducting parts.

4. An insulating structure comprising a conducting rod having an enlarged end, a conducting member surrounding the rod

and having a portion that is substantially parallel to the enlarged end of the rod and another portion that extends laterally from the rod, and a body of insulating material interposed between the rod and said member the exposed portions of which are shaped to substantially conform to the direction of the static lines of force extending between the said conducting parts, the said conducting member extending laterally beyond the insulating body.

5. An insulating structure comprising a conducting rod having an enlarged end, a conducting member surrounding the rod and having a portion that is substantially parallel to the enlarged end of the rod and another portion that extends laterally from the rod, the said member being also provided with a lug, and a body of insulating material interposed between the rod and said member the exposed portions of which are shaped to substantially conform to the direction of the static lines of force extending between the said conducting parts.

6. An insulating structure comprising a conducting rod having an enlarged substantially spherical end, a conducting member having a substantially spherical portion surrounding the enlarged end of the rod and another portion that extends laterally from the rod, the said member being also provided with a rounded rim, and a body of insulating material interposed between the rod and said member the exposed portions of which are shaped to substantially conform to the direction of the static lines of force extending between the said conducting parts.

7. An insulating structure comprising a conducting rod having an enlarged substantially spherical end, a conducting member having a substantially spherical portion surrounding the enlarged end of the rod and another portion that extends laterally from the rod, and a body of insulating material interposed between the rod and said member the exposed portions of which are shaped to substantially conform to the direction of the static lines of force extending between the said conducting parts.

8. An insulating structure comprising a conducting member provided with a recess and a downwardly and outwardly extending petticoat, a supporting rod projecting into the said recess, and an interposed insulating body for maintaining the relative positions of the conducting member and the supporting rod and having its exposed surfaces so shaped as to conform to the direction of static lines which intercept said conducting member.

9. An insulating structure comprising a conducting member provided with a recess and a downwardly and outwardly extending petticoat, a supporting rod projecting into

1,129,521

8

the said recess, and an interposed insulating body for maintaining the relative positions of the conducting member in the supporting rod and having its exposed surfaces so
5 shaped as to conform to the direction of static lines which intercept said conducting member, the conducting member extending laterally beyond the insulating body.

In testimony whereof, we have hereunto

subscribed our names this 23rd day of Dec., 10 1913.

KARL C. RANDALL.
SIDNEY W. FARNSWORTH.
CHARLES LE G. FORTESCUE:

Witnesses:

B. B. HINES,
W. M. McCONAHEY.

FILED MAY 26 1937

IN THE
United States Court of Appeals
FOR THE DISTRICT OF COLUMBIA.

JANUARY TERM, 1937.

No. 6916.

REGINALD A. FESSENDEN, *Appellant*,
v.
CONWAY P. COE, Commissioner of Patents.

APPELLANT'S BRIEF.

EZEKIEL WOLF,
I. R. PARIS,
Attorneys for Appellant.

IN THE
United States Court of Appeals
FOR THE DISTRICT OF COLUMBIA.

JANUARY TERM, 1937.

No. 6916.

REGINALD A. FESSENDEN, *Appellant*,

v.

CONWAY P. COE, Commissioner of Patents.

APPELLANT'S BRIEF.

INTRODUCTION.

This case comes before the Honorable Court of Appeals on an appeal from the District Court of the United States for the District of Columbia on a suit filed by Reginald A. Fessenden against the Commissioner of Patents under the provision of Revised Statutes 4915, to compel the Commissioner of Patents to issue to the applicant, the appellant in the present suit, a patent on an application filed July 28, 1922, for an

invention for an improvement in high tension insulators.

A brief statement of stipulated facts in the case is found in the record pages 20 and 21. As indicated in paragraph 10 of this statement, *THE ISSUE OF THE SUFFICIENCY OF THE DISCLOSURE* was decided by the court below favorably to the plaintiff and the issue of patentability of the claims over said prior patent was decided by the court adversely to the plaintiff. The assignment of error therefore is based entirely upon the issue of the patentability of the invention as defined by the claims set forth in the amended bill of complaint. (Record pp. 4 and 5.)

THE INVENTION.

The invention is described in the patent application reproduced in the record pp. 53 through the first half of 59.

The invention relates to High Tension Insulation and finds its application at the present time among other things in transmission lines for transmitting electrical power of high voltage over a considerable distance from the power source, that is, where the power is generated to the place where the power is to be used. Such transmission lines are well known sights along railroads and across country and embody quite elaborate constructions in the form of high steel towers spaced sometimes considerable distances apart and suspending electric lines from their tops. These power lines, which may carry power supply for a whole community of a considerable size, carry electricity at a high alternating current voltage running up as high as 200,000 volts. At this high voltage the problem of successfully,

economically and efficiently supporting the power lines from the towers offered a considerable problem.

Various means of solution, some more successful than others were devised. One of these is shown in the prior art in the patent to Fortescue No. 1,259,385, patented May 12, 1918. (Record pp. 82, 83, 84 and 85.) This will be discussed later. The solution of the problem by the present appellant and the Patent Office applicant, Fessenden, and Frank W. Peek, Jr., to whom the United States Patent Office issued patent No. 1,741,333 (Record pp. 77 to 81) was the same, although upon consideration of the same prior art in the same manner, the Patent Office saw fit to grant a patent to Peek although it has refused a patent to Fessenden. Both of these inventors, that is, Fessenden and Peek, conceived the idea that the transmission line should be suspended from the supporting structure by a series of *small capacity* insulators (see record pp. 57 and 58 Fig. 1 element numbered 13, 13, etc., and p. 77 Fig. 5, element numbered 40, 40, etc.), and that at the end of the string there should be a conducting element in the shape of a ring No. 17 Fig. 1 (pp. 57 and 58 of the record), Fig. 4, element 50 (p. 77 of the record) which element should be connected to the line to conduct the potential from the line to the extremities of these shields. This electrostatic field or flux controlling means as it is called in the claims takes the potential of the line and extends the field stresses in the neighborhood of the small capacity insulators in such a manner that the stresses in the field about the small capacity insulators provide a uniform potential drop across each insulator so that no insulator will be called upon to bear any greater stress than any other insulator in the row. The particular advantage and utility of

the means and method employed by the appellant over the references that have been held as anticipations are:

1. That Fessenden accomplishes the result by *directly* compensating for the flux distribution about the insulators themselves with the use of only the electrostatic flux distributing ring 17 shown in Fig. 1, p. 57 of the record, and,

2. That this result is accomplished by the use of small capacity insulators.

These particular points are of extreme importance in the present invention and are in fact the prime reasons why the device according to the prior art, that shown in the Fortescue patent, has not been used in insulating high tension lines. (Record page 38 last question and answer.)

As will readily be understood, the high voltage between the line and the ground sets up an extreme electric stress or tension in the neighborhood of the line and this is evidenced by the attractive forces between the positive and negative electricity, well known to everyone. This stress and the forces produced thereby actually denote physical energy which is supplied from the transmission line itself. The amount of energy drawn from the line in creating this field of stress is dependent upon the magnitude of the high voltage and the capacity of the system to store the electrostatic energy as it may be called. The larger in magnitude each of these quantities become, the greater the amount of power the transmission line must supply before the current will be transmitted over it. The first rush of current in the transmission line to fill or set up this electrostatic field is called the charging current and is described by the appellant in his application (Record p. 53) as follows:

“Twenty of them (high capacity insulators as distinguished from low capacity insulators) would have weighed over a ton and the charging current have used up all the power available in damp weather.”

When the rush of current in the transmission line has established the electrostatic field in the neighborhood of the line, the rest of the current transmitted is available for power use so that the charging current actually represents a certain amount of power that is lost. This would be small provided it was necessary only to charge the system once when the line was used. However this charging current is always present because the power is transmitted by alternating current which is current having a cyclic variation and continually changing in magnitude and direction of flow. In this cyclic variation the current increases then decreases and then reverses its direction in increasing and decreasing magnitude necessitating continually a flow of charging current in one direction or another to maintain the proper electrostatic field. If the transmission line and its supporting structure is one that is capable of storing a large amount of electrostatic energy, a good deal of the power will be consumed merely in maintaining the electrostatic field. For an efficient insulating system it was readily understood therefore by the appellant that it was necessary to have insulators that were of such small capacities that very little of the power intended to be transmitted would be wasted by electrostatically charging them. This led the appellant to specify specifically *small* capacity insulators, the use of which created the necessity of employing an electrostatic compensating means which

would directly compensate and create the proper distribution of electrostatic stresses in the neighborhood of the insulators so that each insulator would bear its proportionate potential drop and so that the stresses would not be imposed mostly on the end insulators of the string.

In this respect the small capacity insulators are insulators made entirely of insulating material without any conducting element on their surfaces. The conducting elements on the surfaces of the insulators make virtually a condenser of the insulator of a very high capacity. This is the means which the appellant in his invention specifically avoids and yet obtains a high tension insulating system that is capable of insulating the highest voltages used in commercial systems.

THE CLAIMS.

The claims upon which this appeal is based are found in the record pages 4 and 5. Of these Claims 23 and 24 should be given the greatest consideration since they have been found allowable previously by the Patent Office.

These claims set forth a series of interconnected insulating units suspending the line conductor and carrying an electrostatic flux controlling means conductively connected to the high tension line and spaced about the insulating units *so as substantially to compensate directly for the leakage electrostatic flux* of the string, whereby a uniform voltage distribution results.

The elements of the claim to accomplish the desired results are the sole combination of the insulating units (small capacity units) having no conductive elements and the conductive electrostatic flux controlling means

connected to the conductor to provide compensation directly for the leakage electrostatic flux.

The rest of the claims on pages 4 and 5 of the record set forth elements of the above combination defined to include in the combination at least two of the following:

- A. A plurality of small capacity insulators.
- B. A potential equalizing conductor directly compensating the leakage flux.
- C. The specific form of the equalizing conductor.

SUMMARY.

The distinctive feature therefore in the present invention is that the appellant has taught and shown the method and means respectively of providing in a new way, without going around "Robin Hood's Barn", the position apparently taken by the court below (See record p. 44 last question by the court), a high tension insulating system in which both small capacity insulators are used and the electrostatic field is apparently compensated to provide a uniform potential drop.

The invention herein described and as specifically set forth in claims 23 and 24 of the Bill of Complaint is the same invention and the same claims that have already been held patentable to Frank W. Peek, Jr., in patent No. 1,741,333 after consideration of the same prior art in the same manner as in the matter of the present appellant.

PROCEDURE IN THE PATENT OFFICE.

The record shows that both Fessenden and Peek had adopted the same claims and that the patent examiner, considering these claims allowable over the prior art

including the Fortescue patent No. 1,259,385, the Randall patent No. 1,129,521 and the Thordarson Patent No. 1,288,751 (record p. 20 para. 2) had declared an interference between Fessenden and Peek to determine the priority of invention; that this question of priority of invention was not determined because the interference was dissolved on the grounds that the Fessenden application did not disclose the invention, (This basis of dissolution has been declared in error by the court below (record page 21 paragraph 9)) and the claims of the interference, claims 23 and 24 of the appellant application were awarded to Peek; and that the Patent Office has issued these claims as 1 and 5 (See record page 21 paragraph 8) in the Peek patent.

In the inter-party proceedings in the Patent Office, thorough consideration was given to the patentability of the counts of the interference over the prior art references set forth above. In this connection attention is called to the decision of the Law Examiner in the Patent Office upon the motion to dissolve (Record pp. 68 to 72). This decision indicates that the Fortescue patent No. 1,259,385 which includes the device of the Randall patent No. 1,129,521 and also the Thordarson Patent No. 1,288,751 (Record p. 69) were all considered by the Law Examiner. In view of these citations he states (Record p. 71):

“The counts had been held patentable to Peek by the primary examiner over the Fortescue patent which is as pertinent as other references cited in the motion. If they (the counts) are construed broadly to cover any electrostatic flux controlling means for a string of insulators they would be unpatentable. The alleged unpatentability of the counts is conditioned upon the possibility of a holding that Fessenden can make them.”

The finding of fact of the court below (record, second paragraph, p. 11) "leaves no doubt that the disclosure of the original application meets this requirement". In other words the Fessenden application clearly discloses the matter set forth in Claims 23 and 24 and is entitled just as much to a patent upon these claims as the party Peek was to them.

Claims for the same invention bear only one interpretation and it is not to be construed that the Fessenden application attempts to cover "*any* electrostatic flux controlling means for a string of insulators" any more than the Peek patent should be construed to cover "*any* electrostatic flux controlling means for a string of insulators" (see record, p. 71, lines 25 and 26). Therefore the very same grounds that the Patent Office held as a basis of allowing a patent to Peek should be consistently upheld as a basis of allowing a patent to Fessenden. In the inter-party proceedings before the Board of Appeals where the same record appeared as before the Law Examiner since that was an appeal from the Law Examiner, the Board of Appeals stated, p. 73 record:

"The essential point of novelty of the counts is the arrangement of the grid at the power side of the string of insulators and with the definite limitation that it is to be conductively connected therewith and proportioned and situated so as to substantially compensate *directly* for the leakage electrostatic flux of the string." (Italics ours)

and it was held by the Board of Appeals that while Fessenden's application suggests among other alternative arrangements that of having a ring grid member at the power side of the string of insulators,

“it fails to definitely disclose the very essential limitation that the grid must be conductively connected to the power conductor as required by each of the two counts.”

(Record page 74) In other words the Board of Appeals in the inter-party proceedings made no attempt to state that the invention as defined by the counts was unpatentable, but merely that Fessenden did not disclose the invention of these counts.

This holding of insufficiency of disclosure has been reversed in favor of the appellant by the court below.

It was only when the matter came up again more or less formally before the Primary Examiner and before the Board of Appeals subsequent to the interference proceedings that the Examiner and the Board of Appeals without any grounds held these claims to be unpatentable over the very art over which they previously had considered the claims patentable.

While not a part of this record, the court may take judicial notice of the files of the Peek application to obtain a view of the attitude that the Primary Examiner and Peek took to these references and the invention of the counts of the interference, claims 23 and 24 of the appellant's application.

In the prosecution of the Peek application, the Examiner cited the Fortescue patent in his very first action on the application, paper No. 2, dated February 23, 1922. In response to this citation the applicant Peek in an amendment filed February 15, 1923, made the following statement:

“Nicholson and Fortescue each shows a conducting member near the line end of an insulating string but not so located or proportioned as to supply the desired capacity currents. The Nichol-

son ring 28 is too small in cross section to provide the necessary capacity and his ring 31 at the ground end of the string would prevent proper capacity currents between the ring 28 and the various units in any event. Fortescue requires not only the electrode 18 but also a second electrode 16 which is not connected conductively to the line conductor."

The Patent Examiner did not cite in his next Office action in response to these remarks, that is, the letter of November 17, 1923, the Fortescue patent, and in fact while Claim 8 was rejected on another reference, Claim 9 was said to have allowable subject matter. However the Fortescue patent was again brought forward in the Examiner's letter of September 18, 1926 prior to the declaration of interference. In this letter the Examiner rejected Claims 1, 2, 5, 6 and 11 of the Peek application on the prior Fortescue patent, stating:

"All of these claims with the exception of Claim 2 may be said to read word for word on Fortescue who shows a string of insulators 4 provided with electrostatic flux controlling means 18 conductively connected to the line conductor 1 and proportioned to reform the electric field about the string 4 so as to secure substantial uniform voltage distribution."

This statement indicates clearly that thorough consideration had been given to the Fortescue patent and that the patent was not over-looked by the Examiner in any respect whatsoever.

Apparently an oral interview took place before the next amendment was filed by the party Peek which was on March 7, 1927. In this amendment however, which should of course record any oral agreement between

the Examiner and the applicant, the applicant states as the reasons why the claims previously rejected on the Fortescue patent should be allowed, the following:

“The arrangement disclosed in the Fortescue reference operates on a different principle. Here the conductive members 16 and 18 are at ground potential and the line potential respectively and produces a more or less uniform electrostatic field in the space between them. The insulating units are located in this field where each unit will assume the potential of the particular spot in this field which it occupies. Applicant does not attempt to make the electrostatic field surrounding his insulating unit uniform, but provides his conducting member 20 to supply capacity current to the various units in such varying amounts as to compensate substantially for the various leakages from these units to ground. The two arrangements are thus essentially different as explained to the Honorable Examiner at the interview and it is thought that Claims 2 and 6 clearly and properly distinguish applicant's invention from the Fortescue disclosure.”

This apparently did not wholly satisfy the Examiner who still further considered the Fortescue patent as a basis of rejection of three of the claims which were rewritten for some of the claims in the case, the Examiner stating that these claims distinguished over Fortescue merely by functional limitations (See Office Letter of March 25, 1927). In response to this the applicant in his letter of June 20, 1927 went further into the details concerning the Fortescue patent and set forth the following analysis which is in effect the basis upon which the present applicant claims the allowance of the counts in the interference, claims 23 and 24 over the Fortescue reference:

“As pointed out at the interview, Claims 17 and 18 distinguish from the Fortescue reference by reciting a conductive member connected to the line conductor so as to be at line potential and so as to supply directly to each insulating unit a capacitance current substantially equal to the capacitance current from the unit to ground. In this way, the conductive member causes a substantially uniform distribution of potential among the insulating units.

“In the arrangement disclosed in the Fortescue reference, there is a conductive member 18, connected to the line conductor and which is therefore at line potential. The arrangement and effect of this member are, however entirely different. It cannot alone cause the desired distribution of potential among the insulating units but a cooperating member 16 which is not connected to the line conductor and which is not at line potential is necessary. The conductive member 18 of Fortescue does not supply any direct capacity current to the several insulating units but any such current which gets past the first or lowest insulating unit will pass on to the upper member 16. The members 16 and 18 of Fortescue must be large enough to have the effect of two infinite parallel planes so as completely to shield the insulating units from ground. There is, therefore no capacity current from the insulating units to ground. The arrangement and principle of applicant's device as defined in the claims are therefore entirely different and it is hoped for the above reasons, which were carefully explained at the oral interview, the final rejection of Claims 17 and 18 may be withdrawn and the claims allowed.”

This position apparently satisfied the Examiner who thereupon declared an interference between Peek's claims 12 and 17 which became the Fessenden Claims 23 and 24. In the declaration of the interference the statement is found that Claims 14, 15, 16, 18 and 19 of

the Peek application would be considered unpatentable over the issue of the interference.

This analysis of the prosecution of the Peek application is pointed out more to show that there was no error made by the Patent Office in considering these claims of the interference patentable over the references of the present record and that a thorough consideration of the same prior art presented before the court below was given by the Patent Office and further by the Examiner who is presumed to be the Patent Office expert in allowing the claims in the Peek patent.

THE PRIOR ART.

There were three patents relied upon as anticipations of the invention defined by the claims sought by the appellant. These are the same patents that were considered by the Patent Office in the Peek case on the same claims and were there on the same invention held patentable to Peek.

Only the Fortescue patent No. 1,259,385 is at all pertinent as admitted by the court below in the finding of facts (record pages 11, 12 and 13).

The Fortescue patent shows three of the units shown in the Randall patent No. 1,129,521 interconnected together. Each of these units (record page 82) comprises an insulating element shown in the drawing in black with white lines and a shield and conducting element 8 superimposed upon the insulating element and called a condenser 5 (record, p. 83, line 94). This shield element 8 not conductively connected to the line and the line shield 3 and 18 allegedly produce the desired even voltage distribution mentioned in the patent.

As recognized by the court below (record p. 44) if this does establish an even potential distribution it is

by means different from that taken either in Peek or in Fessenden 'by Robin Hood's barn'.

However, this difference in means employed has a real purpose and a beneficial result. In the first place, Fessenden avoids using a high capacity unit which Fortescue calls a condenser. This eliminates the loss encountered in charging the condenser and makes the transmission of power more efficient. Secondly, the shield used in Fessenden is so proportioned and situated that it *directly compensates for the electrostatic* leakage current and not through intermediate means that bring about severe losses, raise the cost of the insulator, and that otherwise are comparatively inefficient. It is quite understandable that the Fortescue insulator is not in commercial use as a high tension insulator.

CONCLUSION.

The invention of Fessenden and Peek is in effect a new combination that conceives a new method of insulating a high voltage line. It uses a string of small capacity insulating units connected one to the other with a metallic ring connected to the line and located about the string to distribute the high voltage at such points in space to make the voltage drop uniform across each unit of the string.

Respectfully submitted,

EZEKIEL WOLF,

I. R. PARIS,

Attorneys for Appellant.

UNITED STATES
COURT OF APPEALS FOR THE
DISTRICT OF COLUMBIA

FILED JUN 17 1937

Monroe Burton

No. 6916

**In the United States Court of Appeals
for the District of Columbia**

JANUARY TERM, 1937

REGINALD A. FESSENDEN, APPELLANT

v.

**CONWAY P. COE, COMMISSIONER OF PATENTS,
APPELLEE**

**APPEAL FROM THE DISTRICT COURT OF THE UNITED
STATES FOR THE DISTRICT OF COLUMBIA**

BRIEF FOR THE COMMISSIONER OF PATENTS

R. F. WHITEHEAD,
Solicitor, United States Patent Office.

W. W. COCHRAN,
*Law Examiner, Patent Office,
Of Counsel.*

**In the United States Court of Appeals
for the District of Columbia**

JANUARY TERM, 1937

No. 6916

REGINALD A. FESSENDEN, APPELLANT

v.

**CONWAY P. COE, COMMISSIONER OF PATENTS,
APPELLEE**

*APPEAL FROM THE DISTRICT COURT OF THE UNITED
STATES FOR THE DISTRICT OF COLUMBIA*

BRIEF FOR THE COMMISSIONER OF PATENTS

This case comes before the court on appeal from the decree of the District Court of the United States for the District of Columbia holding appellant not entitled to a patent including claims 5, 6, 9, 10, 11, 14, 15, 16, 23, and 24, of his application No. 532,488, filed January 28, 1922, and dismissing appellant's bill brought under the provisions of section 4915 R. S., to authorize the Commissioner of Patents to issue appellant a patent including said claims.

The subject matter of appellant's application is an insulator for use in supporting a high tension electric power transmission line from a supporting pole or tower. Where the current carried by the power line is of high voltage there exists a great difference in electric potential between the power line and supporting pole or tower, and unless the insulating means connecting the two is of sufficient insulating capacity the current will break through the insulator. A single insulator of sufficiently great capacity for use on power lines carrying high voltages would be of prohibitive size. To overcome this difficulty the string type of insulator was developed and became well known several years before appellant filed his application. See testimony of plaintiff's witness (R., pp. 46 and 47).

This type of insulator consists of a number of relatively small insulator elements conductively connected to each other to form a string, one end of the string being conductively connected to the pole or tower and the other to the power line to be supported. Examples of this type of insulator are shown in Fig. 1 of the patent to Peek, No. 1,741,333 (R., p. 78), in the drawing of the patent to Fortescue, No. 1,259,385 (R., p. 82), and diagrammatically in Fig. 1 of the drawing of appellant's application (R., p. 57). In this type of insulator the total stress existing between the power line and the supporting tower is not carried by each element of the string but is distributed among such

elements. The distribution of stress, however, is not equal, the end elements of the string being subjected to a greater stress than the intermediate elements. This fact also was well known several years before appellant's application was filed. See testimony of appellant's witness (R., p. 47). To equalize the stress on the individual insulating elements of the string appellant provided a cup-shaped shield at each end of the string, as may be seen in Fig. 1 of his drawing (R., p. 57) and this is the subject matter on which he seeks a patent.

Appellant's application was filed on January 28, 1922. Nearly four years before that the Fortescue patent was granted. This patent discloses a suspension insulator of the same type as that disclosed by plaintiff. It includes a series of insulating bodies 13 connected in series by means of members 11 and 5, and shield members 16 and 18 at the ends of the series for the purpose of shielding the lowest one of the insulated bodies 13 from excessive voltage drop. As showing that Fortescue was dealing with the same problem and provided the same solution therefor as plaintiff, the following portion of the Fortescue specification (R., p. 84, first column) is quoted:

My invention comprises a system of condensers connected in series relation to enhance the insulating properties of which it is highly desirable to obtain uniform divisions of potential difference between the ele-

ments 5. In order to increase the insulation strength of my insulator, the external electrostatic field surrounding the same should be so distributed as to insure a substantially uniform surface distribution of the electrostatic stresses imposed thereupon. For this purpose, I have provided an upper conducting member 15 having a conducting extension 16 of discoidal shape and a lower conducting member 13 having a conducting extension 18 of discoidal shape.

It is desirable, for maximum efficiency, and in order that my improved insulator may be of minimum length, that the external electrostatic field be substantially uniform and agree with the division of potential between the individual elements 5 comprised in the structure 4. The electrodes 16 and 18 are provided to approximate the result which would be obtained by bounding the insulating support 4 by infinite parallel conducting planes perpendicular to the axis of the insulator. As above mentioned, this will effect a substantially uniform distribution of the electrostatic field external to, and surrounding, the insulator 4. The condition for uniform distribution of potential among the elements 5 is that the fluxes leaving the electrodes 8 shall be of like value; this means that the capacitance of each electrode 8 to ground must be inversely as its potential, and that the capacitance between adjacent pairs of electrodes must be uniform. This is

approximated very closely if the parallel plane surfaces or the flux distributing surfaces of the upper or low-potential electrode 15 and the lower or high-potential electrode 3 coincide with, or lie in the planes of, the lower edges of the electrodes 16 and 18, respectively. An insulator made according to the above plan conforms to the law of uniform fields, and is insured against concentrations of electrostatic stresses upon its surfaces.

In view of this disclosure it is submitted that the shield members 16 and 18 of Fortescue are identical in purpose and operation with the similar shields of appellant's device.

For convenient consideration, the claims on appeal may be divided into the following three groups:

Group I: Claims 5, 6, 15, 16, and 24.

Group II: Claims 9, 10, 11, and 23.

Group III: Claim 14.

It is submitted that all of the claims of Group I are directly and fully met by the Fortescue patent. It is not deemed necessary to discuss each of these claims separately as a discussion of claim 5 will state appellee's position as to all.

In the following parallel columns the claim is set forth in the left hand column and the elements of the Fortescue patent corresponding to those recited in the claim are set forth in the right hand column:

Claim

In high tension insulators, a conductor to be insulated,

an insulator string embodying a plurality of small capacity insulators connected in series,

and a potential equalizing conductor electrically connected with said conductor to be insulated

and spatially related to a unit of said insulator string in immediate proximity to said conductor to be insulated,

whereby said unit is relieved from undue electrical stress and such stress distributed across the units of the string, and whereby said conductor to be insulated is thereby enabled to withstand a higher voltage.

Fortescue Patent

The conductor is shown at 1.

The insulators are shown at 13 and are connected in series by the members 11 and 5.

The equalizing conductor or shield is numbered 18 and is electrically connected to the conductor 1 by means of the member 2 (see Fortescue specification page 2, lines 78 to 81).

The member 18 is spatially related to the lowermost unit 13 of the insulator string and is in immediate proximity to the conductor 1.

That the shield member 18 relieves the lowermost insulating element 13 from undue electrical stress and distributes such stress across the remaining units of the string is clearly evident from the above quoted portion of the Fortescue patent.

The claims of Group II are somewhat more specific than those of Group I in that they recite that the shield members are arranged around or surround one or more of the insulating elements. Some of these claims also recite the form of the shield as being cylindrical or circular in cross-section. It is obvious that a cross-section through the member 18 of the Fortescue device perpendicular to the longitudinal axis of the string will be circular.

The cylindrical form of plaintiff's shield whereby it may partially surround the end insulating member is deemed to be a mere colorable variation of the form of the shield shown in the Fortescue patent since it is obvious from the quotation made above from the patent that the operation of both shields is the same.

Aside from these limitations the claims of this group are met by the disclosure of the patent in the manner set forth above in the discussion of claim 5.

This leaves for consideration Group III, consisting of the single claim 14. This claim recites nothing not already discussed except that the lip portion of the shield is of widened cross-section. This part of the claim has reference to the portion indicated by the numeral 19 in Fig. 2 of appellant's drawing (R., p. 57) and the similar enlarged rim portions of the member 17 shown in Fig. 1. Appellant in his application does not disclose the partic-

ular operation of these enlarged portions. He merely states that he has experimentally found that they are advantageous (R., p. 55, lines 23 to 25). Whatever their function may be, however, it is submitted that no invention was involved in adding them to the lower edge of either of the members 16 or 18 of Fortescue in view of the teaching of the patent to Randall et al., No. 1,129,521 (R., pp. 90 to 93). This patent shows such a lip of enlarged cross-section at 11, in Figs. 2 and 3. Concerning the purpose of this enlarged lip, the patent states (R., p. 91, column 2, line 95 to 98) that it avoids concentration of stress upon this portion of the shield.

For the reasons above set forth it is submitted that none of the claims on appeal recites anything amounting to invention over the disclosures of the patents to Fortescue and Randall et al.

Appellant has laid particular stress on the fact that claims 23 and 24 were allowed by the Patent Office in an application of Frank W. Peek, Jr., which matured into patent No. 1,741,333, on December 21, 1929.

The allowance of these claims to Peek was made upon a consideration of the same patent to Fortescue as is here relied on. Upon a further consideration of the same patent in connection with the same two claims in appellant's application, the same were rejected as unpatentable thereover. Whether the actions of the Patent Office in the two cases have been consistent or not, it is submitted

that the only question for determination here is whether the claims on appeal are patentable over the prior art and the fact that they have been allowed to another should not be controlling. If they are not patentable over the prior art it is obvious that they should not be allowed again.

This court had a similar situation before it in the case of *In re Orcutt, Assignor to The Standard Scale & Foundry Company*, 141 O. G. 567; 32 App. D. C. 345. There the claims on appeal had been allowed in the application of another and the patent thereon had been granted and an interference between the patent and the appellant's application had been dissolved on the ground that the claims of the Orcutt application were unpatentable to him in view of certain prior art. In its decision this court held that it would probably have been the more equitable practice to have assumed patentability in the interference proceeding for the purpose of determining the question of priority but that it was within the scope of the Commissioner's authority to dissolve the interference if convinced that the issue was not patentable.

It was then said:

Should we declare the rejected claims patentable, the result would be that an interference would again be declared and the question of priority determined. It will thus be seen that the decision of the Commissioner dissolving the interference did not preclude Orcutt, if there was merit in his

claims, from ultimately contesting the question of priority with the patentees McDonald and McDonald.

The Court then discussed the references and affirmed the rejection of the claims thereon.

It is submitted that in accordance with this decision it was not improper for the Patent Office to reject appealed claims 23 and 24, notwithstanding that they had been patented to another, when upon mature consideration they were found to be unpatentable.

CONCLUSION

It is submitted that the decree of the lower court dismissing the Bill should be affirmed with costs against the appellant.

R. F. WHITEHEAD,

Solicitor, United States Patent Office.

W. W. COCHRAN,

Law Examiner, Patent Office, Of Counsel.

FILED FEB 9 - 1938

Joseph W. Stewart
CLERK

**In the United States Court of Appeals
for the District of Columbia.**

JANUARY TERM, 1937.

No. 6916.

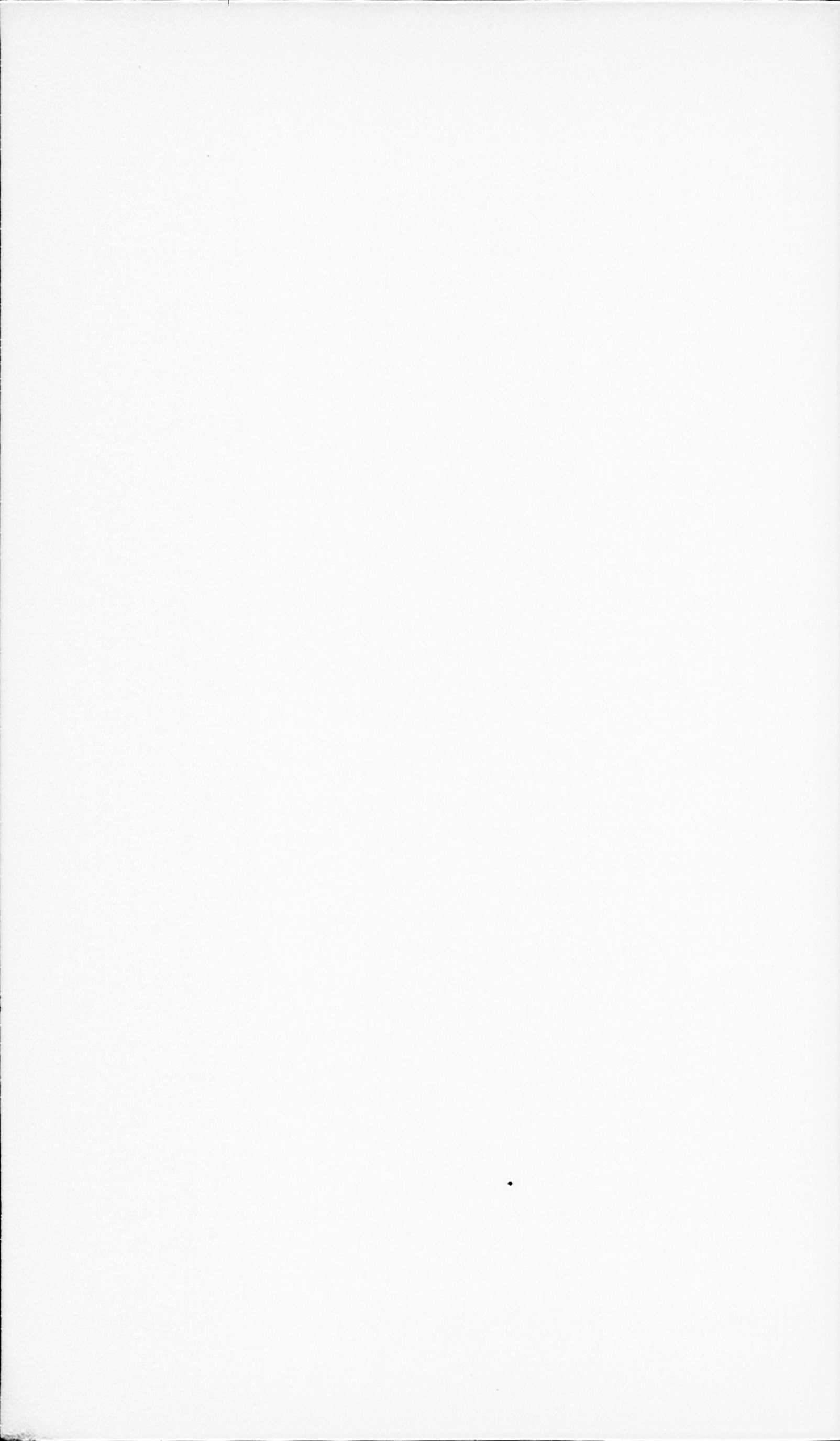
REGINALD A. FESSENDEN, *Appellant*,

v.

CONWAY P. COE, COMMISSIONER OF PATENTS.

REPLY BRIEF FOR APPELLANT.

EZEKIEL WOLF,
Attorney for Appellant.



In the United States Court of Appeals for the District of Columbia.

JANUARY TERM, 1937.

No. 6916.

REGINALD A. FESSENDEN, *Appellant*,
v.

CONWAY P. COE, COMMISSIONER OF PATENTS.

REPLY BRIEF FOR THE APPELLANT.

In the brief for the Commissioner of Patents the Commissioner has strongly argued the non-patentability of the claims over the Fortescue patent No. 1,259,385, and has applied (page 6 of the brief) the appellant's claim 5, and stated with reference to the other claims (page 5 of the brief):

“It is not deemed necessary to discuss each of these claims separately as discussion of Claim 5 will state appellee's position as to all.”

The Commissioner in doing this avoids the consideration of claims 23 and 24, which are the identical claims 1 and 5, respectively, of the Peek patent No. 1,741,333, patented in the United States December 31, 1929 (Record, page 81).

In allowing these claims the United States Patent Office had before it and gave thorough consideration

to the Fortescue patent now relied upon so strongly by the Commissioner as a basis of the refusal of a patent to the present appellant.

The question naturally presents itself: Why, if these claims in spite of the Fortescue patent were considered allowable and patentable to the party Peek, and a patent issued, the same benefits could not be given to the appellant, who stands in the same position exactly as the party Peek?

Before coming to this question, for the purpose of answering the analysis of the Commissioner as set forth on page 6, the Honorable Court should note that the claim as set forth on page 6 of the Commissioner's brief in the second portion provides for *small capacity insulators*, which is not shown in the corresponding portions identified with the Fortescue patent. This is distinctly explained by the expert witness (Record, page 38):

“Secondly, the Fortescue insulator elements are elements of high capacity. They are of high capacity because the insulators with the metal members form condensers, and condensers in which the metal or conducting armatures or plates of the condenser are relatively of large area and of relatively small separation through the dielectric or insulator. So in consequence this type of insulator would have a high charging current when used on a power transmission line, and a still higher charging current or displacement current through the string when used at the higher frequencies of radio.”

Further, the claim sets forth—

“a potential equalizing conductor . . . whereby said unit is relieved from undue electrical stress

and such stress distributed across the unit of the string and whereby said conductor to be insulated is thereby enabled to withstand a higher voltage.”

In the Fortescue patent the member 18 is not the sole potential equalizing conductor, but must co-operate with the local conducting elements 10, for instance, which are not connected *with the conductor to be insulated*.

These very distinctions were not only brought out in the testimony by the expert as in the extract of the record, pages 37 and 38, just below:

“The conjoint action of these end members 16 and 18 and the individual shields or metallic portions of the Randall insulators are shown at 15 and 5 in the upper two members of the string.

“The Court: You mean that 15 in the Fortescue patent is similar to 5 in the Randall patent?

“The Witness: Yes, sir. It is the same shaped member, your Honor.

“The Court: Yes; I see.

“The Witness: I do not find on the third insulator a designated number for that shield, but the shield is shown as of the same character as the two upper ones. Through the conjoint action of the members 16 and 18 in these metallic shields, the members of the Randall insulators between the voltage acting across each one of the insulator units is equalized. This equalization results from the combined action of the end shields or members 16 and 18, and, as I have said, these inner elements—

“By Mr. Wolf:

“Q. May I interrupt one moment to ask you to point out this. Are the shields over the insulators metallic elements? A. They are metallic elements; that is, they are conducting elements.

“The Court: Are they encased?”

“The Witness: They are practically encased your Honor. They are shown as conical or funnel shape metal members, and they enclose the greater part of the insulator inside.

“The only part that is in any way exposed is the lower face of each insulator.

“The Fortescue arrangement differs from that arrangement shown and claimed in the Fessenden application in two ways. In the first place the equalization of strain on the separate insulator units of Fortescue is not accomplished directly by the end shields or elements 16-18. It is accomplished if at all indirectly; that is by the conjoint action of these shields 16 and 18, and the smaller or individual insulator shields”—

but also were relied upon as patentable differences by the Commissioner and by the party Peek in the allowance of the Peek patent.

The Honorable Court below expressed the view (Record, page 12) “That Fortescue and the plaintiff [appellant] were dealing with the same problem and found the same solution.” This was assigned as an error (Record, page 16, paragraph numbered 7). *It is respectfully submitted that, while Fortescue and the appellant were dealing with the same problem, the solutions are distinctly different.*

In the Fortescue patent the inventor has employed a high potential insulator series of units which have an insulating element surrounded by a hooded conductor. These are suspended one from the other and suspend the line conductor. At the end units of the group, conducting shields 16 and 18, as set forth in the Commissioner’s brief, are provided, which, together with the conducting elements on the individual

insulators, distribute the electrical stress so as to prevent breakdown.

The problem as solved by Fessenden, the present appellant, was to use so-called *small capacity insulators* as contrasted with the high capacity insulators of Fortescue (see Record, page 38, and the quotation above), and further *directly equalize the potential stress by a single equalizing conductor*.

Clearly, while the problems dealt with by Fessenden and Fortescue might have been the same, the solutions were entirely different.

To get back to the question of the basis of the allowance of the claims in interference to Peek over the Fortescue patent, the Honorable Court is respectfully requested to take judicial notice of the file on record in the Patent Office of the Peek patent (Record, pages 77 to 81). *From this Patent Office record it will be seen that the claims were allowed in the Peek patent over the Fortescue prior patent on the basis of the very same argument as set forth here and presented before the Court below.*

In paper No. 2, mailed February 23, 1922, the Fortescue Patent No. 1,259,385 was cited by the Patent Office. In the amendment which Peek filed on February 13, 1923, he made the following statement:

“Fortescue requires not only the electrode 18 but also a second electrode 16 which is not connected conductively to the line conductor. These claims 8 and 9 recite a single flux controlling member so arranged as to attain the desired result.”

Following this, in paper No. 5, November 17, 1923, the Commissioner of Patents continued to reject claim

8 on the Fortescue patent, but held that claim 9 had allowable subject-matter.

The Fortescue patent was mentioned again in the prosecution of the Peek application in the letter of the Commissioner of Patents, paper No. 10, of September 18, 1926, after claims 8 and 9 and certain other claims were allowed. The Examiner stated in this paper with regard to the unallowed claims:

“All of the Claims with the exception of Claim 2 may be said to read word for word on Fortescue who shows a string of insulators 4 provided with electrostatic flux controlling means 18, conductively connected to the line conductor 1, and proportioned to reform the electric field about the string 4 so as to secure substantially uniform voltage distribution.

“Attention is particularly directed to line 12-77 of page 2 of Fortescue’s specification.”

In fact, this part (page 2, lines 12-77) of the Fortescue specification was relied upon by the Honorable Court below as indicated in the finding of fact, Record, page 12. This position, however, was not retained by the Patent Office Examiner, who is considered the expert in this respect in the Patent Office, for in papers filed March 7, 1927, and June 20, 1927, wherein claims 12 and 17 are the identical claims 23 and 24 here presented, the Examiner admitted by the final allowance of these claims the validity of the argument which Peek presented in these papers.

The argument there presented has the same basis as the argument given by the appellant and presented clearly in the uncontradicted testimony of the expert. In this respect attention of the Court is di-

rected to the analysis of claim 23 given by the expert, pages 33 and 34. In this the expert stated:

“Q. Will you explain the expression ‘so as to compensate directly for the leakage’? A. The expression ‘so as to compensate directly’ means this, that the distorted field, the undesirably distorted field, which would have existed across the insulator string—that is, the field that I have already described as concentrated on and through the end insulators—is now directly, by the single agency of the shields straightened out so that the strain across each one of the insulators is made substantially the same as across any other one of the insulator elements.”

In the Fortescue patent, as the expert later explained and as quoted above, this is not accomplished directly, but indirectly through intermediate elements which necessarily provide *high capacity insulators* and the resulting disadvantages that the appellant recognized and wished to avoid (see Record, last paragraph page 28, and page 29).

The means employed by the appellant were not merely obtaining the desired result without going around “Robin Hood’s Barn,” as the Court below expressed, but rather the means used effected a distinct utility in the art as explained by the expert in the testimony, pages 28 and 29. In fact, the insulating system shown in the Fortescue patent has never come into extensive use as contrasted with the system disclosed in the appellant’s application, and this without doubt is due to the fact that the Fortescue insulators are of such high capacity as to be undesirable in high tension work for which they were designed.

The Primary Examiner in the Patent Office was not alone in holding that claims 23 and 24 presented patentable novelty over the prior art.

The Law Examiner on November 5, 1938, rendered an opinion (Record, pages 68 to 72) in which he states:

“The counts have been held patentable to Peek by the primary examiner over the Fortescue patent which is as pertinent as other references cited in the motion. If they are construed broadly to cover any electrostatic flux controlling means for a string of insulators, they would be unpatentable. The alleged unpatentability of the counts is conditioned upon the possibility of a holding that Fessenden can make them.

“The claims submitted in the motion to amend cannot be made by Fessenden for the reason stated in discussing the existing counts. They appear to be patentable over prior art.”

The Board of Appeals also considered the claims in interference, present claims 23 and 24 allowable in the interparte appeal between the party Fessenden and Peek, Record, pages 72 to 75, inclusive:

(Page 73:) “The essential point of novelty of the counts is the arrangement of the grid at the power side of the string of insulators and with the definite limitation that it be conductively connected therewith and proportioned and situated so as to substantially compensate directly for the leakage electrostatic flux of the string.”

SUMMARY.

It will therefore be seen that the Patent Office consistently held the claims presented here by the appellant to be patentable.

Further, the claims were held patentable after a thorough consideration of the very references upon which the Commissioner now relies. The testimony of the expert before the Court below remains uncontradicted in this respect.

Clearly, therefore, in view of this status, the balance of novelty and patentability should be decided in favor of the appellant.

Respectfully submitted,

By EZEKIEL WOLF,
Attorney for Appellant.